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VETERINARY MEDICINE

SEPTEMBER 1943

CONTENTS

Veterinary Progress, Policies and Comment.....321-328

Allocation of Penicillin, 321; Anthrax in Alabama, 321; Edible Food Consigned to Garbage, 321; Contribution of Space to the War Effort, 321; Argentine Appropriation for Eradication of Foot-and-Mouth Disease, 321; Rats Infected with Leptospirosis Trapped in Washington, D. C., 321; Quinine for the Armed Forces, 322; Sergeant Huffnall Decorated, 322; Care of War Wounded, 322; Sea Water Distilled, 322; Proposed Pharmacy Corps for the Army, 322; Col. Leininger Retired, 322; Man Hours Required of Dairy Farmers, 323; Large Decrease of Horses in Warring Countries, 323; June Pig Crop Report, 323; Study Proteins in Feeds, 323; New Chief of B.A.I., 324; Wickard Announces Retirement of Mohler from B.A.I., 324; Veterinariorum Seniores, 326; Trust in Veterinarians, 326; Problems in Meeting the 1943 Goals for Animal Production, 327; Estimated Waste of Edible Meat in Marketing Livestock, 328; Administration of Essential Amino Acids to Maintain Nitrogen Equilibrium, 328.

Horse Facts and Figures.....329

Artificial Insemination 333

The Effects of Sulfaguanidine and Sulfasuxidine in a Natural Outbreak of Ovine Coccidiosis.....337

Veterinarians and the Cancer Problem.....340

Practical Livestock and Poultry Nutrition.....343

Autobiography of a Veterinary Practitioner.....348

Acute Tympanitis in Ruminants.....351

Parasite in the Spermatic Sheath of a Colt.....352

Recto-Vaginal Fistula with a Tear Through the Anal Sphincter in a Cow.....352

Salt Pork Poisoning in an Irish Setter.....353

Solanine Poisoning in Swine.....353

Urinary Calculus in the Hog.....354

Abstracts 355-358

Sulfathiazole Topically in Infected Wounds, 355; Diagnosis of Leptospirosis, 355; Increasing Sheep Production Through the Control of Internal Parasites, 355; Vaccination Against Strangles, 356; Facts and Fancies Concerning Brucellosis Control, 357; Crystal-Violet Vaccine for the Prevention of Hog-Cholera, 357.

Book Reviews 359-360

Dictionary of Bio-Chemistry and Related Subjects, 359; Behind the Sulfa Drugs, 359; Victories of Medicine, 359; Virus Diseases, 360.

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No. 9

Entered as second-class matter Nov. 8, 1920, at the post office at Chicago, Ill., under the Act of March 3, 1879.

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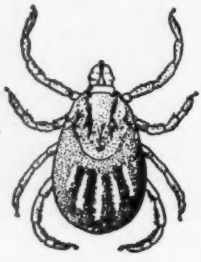
Jen-Sal

for Ticks 2



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Allocation of penicillin began July 16, when Order M-338 became effective.

Late in June an outbreak of anthrax occurred in Mobile County, Alabama. Twelve animals and two men succumbed.

It is estimated that under normal conditions in this country, 300 pounds of edible food products per person per year are consigned to garbage—a total of 40 billion pounds yearly.

l'Effort (May, 1943) reports that after 10 years of research Prof. Gaston Ramon and assistants have discovered a serum, obtainable from horses, for use in foot-and-mouth disease. In 1937 there was a loss in France of one million head of cattle from this disease.

The publicity industries have contributed approximately a quarter of a billion dollars in time, space and services to the war effort during the past year. Major contributors were: Radio industry, 100 million, newspapers and magazines 100 million and advertising agencies four million dollars. These agencies plan to contribute 500 million dollars worth to the cause during the coming year. VETERINARY MEDICINE is cooperating fully in this program.

Foot-and-mouth disease, presumably spread by hay imported from the Ukraine, is raging around Riga.

The Argentine government is reported to have appropriated $1,500,000 for the eradication of foot-and-mouth disease from that country.

In World War I, an average of 94 pounds of metal were required for each man in the armed forces of the U. S.; in the present war the amount needed is 4,900 pounds—nearly 2½ tons!

Nearly 50% of 92 rats trapped at various places (residences, jail, garbage dump, etc.), in Washington, D. C., were found to be infected with *Leptospira icterohaemorrhagica*. The agglutination test was more than 97% accurate in the detection of leptospirosis.

Many experiments on animals, some of them dating back to 1920, show that calcium and phosphorus are utilized more efficiently by the animal organism when there is an ample supply of vitamin D. That is an ample supply of vitamin D increases the capacity for absorption and retention of these elements, particularly when the supply of either or both is low or their ratio to one another distorted.

Enough quinine (three tons) for nine million doses of five grains each, was presented to the armed forces, May 14, by the American Pharmaceutical Association. The collection of quinine was begun the middle of February by thousands of American druggists.

Staff Sergeant William Huffnall, son of Dr. and Mrs. W. T. Huffnall, Houston, Texas, has received a citation from the President and been awarded the Air Medal for outstanding performance as a radio gunner on a Liberator in the Philippines, Netherlands, East Indies and Java. Of recent months Sgt. Huffnall has been stationed in India and has taken part in many missions over Burma.

Care of War Wounded*

The Army has medical installations in every country in the world not held by the Axis, and as soon as it moves into Axis territory, it expects to set up medical units to care for the civilian population. This will be done in order to protect the Army from infectious diseases prevalent among civilians.

Plasma, surgery and sulfa drugs are credited in that order for the great saving in lives. Sulfa drugs will aways come second to surgery and third to plasma in saving the wounded. This is because shock and hemorrhage and bomb or shell fragments are the biggest threats to the life of the wounded.

An astoundingly small number of wounded have had the serious bone infection, osteomyelitis, which occurred in 75% of compound fractures in the last war. In all the base hospitals in Africa, up to April 30, there were only 70 cases of this condition. In one group of 373 compound fractures, there were only five or six cases of osteomyelitis, instead of the 279 which the last war's 75% rate would have given.

Later the General is reported to have said that the death rate in the army's evacuation hospitals during the African campaign was "the lowest rate of any army at any time."

*Excerpts from address before House of Delegates of the A.M.A. June 7, by the newly appointed Surgeon General of the Army, Major General Norman T. Kirk.

All of Britain's life boats and ocean-going merchant ships are equipped with apparatus for distilling sea water for drinking purposes.

Soviets Kekcheyeo, Derzhavin, and Pilipchuk, Moscow, state that by interaction of afferent systems they are able to reduce the adaptation of the eye in passing from light to darkness from 45 to 50 minutes (the normal period) to five minutes. Their method consists of gentle stimulation of other special senses, particularly taste and hearing.

Proposed Pharmacy Corps for the Army

A bill setting up a pharmacy corps as part of the Army Medical Department has been passed by Congress. Under direction of 75 commissioned pharmacists, the Corps would attempt to give the army the best pharmaceutical service available. Should the President sign the bill, the Surgeon General's office will decide what course of action is best for the army.—*Science.*

Colonel Leininger Retired

Col. Daniel B. Leininger, V.C., was retired June 20, 1943, at Fort Ord, Calif., after 32 years in the Army. A formal review by the troops at Fort Ord was given in his honor, June 25th.

Col. Leininger was graduated from the Kansas City Veterinary College in 1906 and spent five years in the federal Bureau of Animal Industry. He accepted an appointment in the army in 1911 and in the intervening years has served in all parts of the United States and its possessions, including two periods in the Philippine Islands. He took part in the punitive expedition into Mexico in 1916-17 and was Director and Senior Instructor of the Department of Hippology of the Cavalry School at Fort Riley, Kansas, during World War I. He has been active in horse shows throughout his military career and veterinarian to Hunt Clubs at Fort Bliss, Tex., and Fort Sill, Oklahoma. He was M.F.H. of the Hunt Club at Fort Ord at the time of his retirement.

The protein value of a food depends upon the amount of protein contained in the food, the completeness with which it is digested and the quality or the biological value of the protein. The foods which are of animal origin are the only ones which completely fulfill these criteria of high protein quality.—*H. E. Robinson.*

Most farmers harvest their crops once a year, but the dairy farmer must harvest his whole crop 730 times a year. More labor is required for dairy production than for any other farm crops. The U. S. Department of Agriculture estimates the labor required of dairy farmers as follows:

1. Care of lactating cows—3,780,000,000 man hours.
2. Care of calves, heifers and bulls—100,000,000 man hours.
3. Producing feed—1,344,000,000 man hours.

Large Decrease of Horses in Warring Countries

In 1939 the countries of Europe possessed about 40,000,000 horses. Since the outbreak of the war, because of lack of feed and for other reasons, horse breeding has been greatly lessened in occupied countries, loss from attrition abnormally high and from killing for food ahead of requisition much higher. Only Germany is supposed to have more horses now than when the war began. The number in Russia is presumed to have decreased by ⅓; in England, Holland, Belgium, and the Baltic States by ½; in Poland, Czechoslavia, Jugoslavia and Greece by ⅔; in other countries by lesser amounts. It is estimated Europe will be short anywhere from five to ten million of the number of horses used in Agriculture before the war. This lack of horsepower, which can be replenished only in part from Australia, Argentine and the United States, may be the limiting factor in food production after the war. In only Germany and Poland has any considerable mechanization of agriculture occurred since war began. Farming in most of the remainder of Europe does not lend itself to intensive use of motor equipment.

Pig Crop Report—June, 1943

A spring pig crop in 1943 of about 74,000,000 head is estimated by the Department of Agriculture in its June pig crop report. This is about 13,000,000 head or 22% larger than the 1942 spring pig crop. A 1943 fall pig crop of about 53,000,000 head is indicated by farmers' reports on sows bred or to be bred to farrow this fall. This is about 9,000,000 head or 21% above the 1942 fall pig crop. Spring and fall pig crops combined would give a total of about 127,000,000 head, compared with about 105,000,000 head in 1942 and a 10-year average of 73,148,000. The estimated number of hogs over six months old on June 1 this year far exceeded the number in any other year and was 26% above June 1, 1942.

Announcement from the War Manpower Commission

Because the Selective Service System will not defer veterinarians who are not essential in their communities and very few of those who are inducted in the army can expect to receive a commission, the Directing Board of the War Manpower Commission's Procurement and Assignment Service is urging non-essential doctors of veterinary medicine to relocate in communities where their services are urgently needed.

In a letter to state chairmen for veterinarians the Directing Board says it has been informed that local boards of Selective Service, in classifying the registrant, will consider his essentiality in the community to which he may move.

"Therefore," the board states in its letter, "if a Doctor of Veterinary Medicine is found not essential in his community but moves to one where he is essential, consideration will be given to an occupational classification.

"In order to safeguard and provide veterinary medical service where it is essential, you are requested to encourage necessary relocations and make appropriate recommendations in behalf of the veterinarians concerned to your State Director of Selective Service."

New Chief of B. A. I.

Harris and Ewing
Arthur W. Miller

Dr. Arthur W. Miller, assistant chief of the Bureau since 1928, has been appointed chief. Doctor Miller is a thoroughly experienced administrator and has been in the thick of developments which have helped strengthen and protect our great livestock industry. He will carry on and continue to develop the many constructive programs and policies of the Bureau.

Doctor Miller was born in 1876 at Manchester, New Hampshire, spent his early years on a ranch near Junction City, Kansas, and was interested in livestock raising at the time he entered the Kansas City Veterinary College, from which school he was graduated in 1901. The doctor immediately became affiliated with the Bureau of Animal Industry. His assignments included meat inspection and disease eradication work until 1917 when he went to Washington, D. C. He has been successively chief of three different divisions of the Bureau.

Wickard Announces Retirement of Mohler from B. A. I.

Dr. John R. Mohler, Chief of the Bureau of Animal Industry since 1917, retired July 31 as was foretold in the June issue of VETERINARY MEDICINE. Doctor Mohler has been with the Bureau more than 46 years—more than three-quarters of the period the Bureau has existed.

In the little less than 60 years since the Bureau of Animal Industry was created, the United States has risen from the rear ranks to a position of world leadership in livestock and veterinary research. Doctor Mohler has been closely identified with much of that progress. As a scientific leader and administrator, he has helped the Department of Agriculture perform a great service for the people of the United States —a service from which all of us have received many benefits.

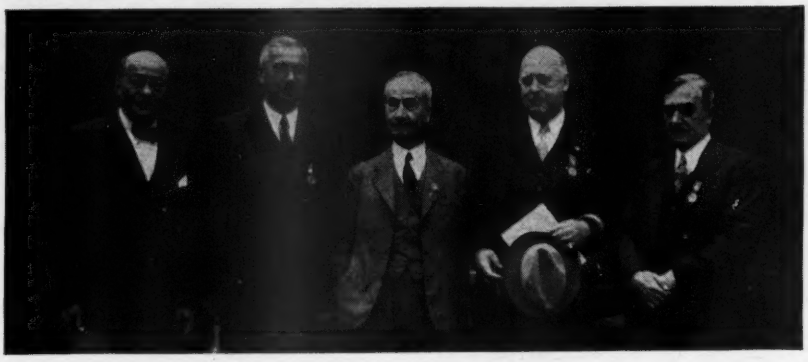
The work of the Bureau of Animal Industry today covers a wide field of activities. These include scientific research in breeding, feeding, and management of livestock; a continuous program covering the entire Nation to prevent and control infectious diseases of farm animals; and various regulatory and inspection services.

We are justly proud of our great livestock industry. The fact that we have such tremendous livestock resources and such a well-worked-out program for guarding livestock against the ravages of disease adds to our national security. Patient scientific research over many years, plus the facilities for safeguarding the animal products flowing to consumers, are paying dividends in more and better food to meet unprecedented wartime demands.

I am glad to acknowledge at this time some of the outstanding achievements with which Doctor Mohler's name has been associated. Heading the list, perhaps, is the highly successful eradication of bovine tuberculosis. This tremendous undertaking, covering the entire country, was once opposed as "impossible." Nevertheless, the country is now virtually free of this plague.

Another great accomplishment—one that

I cannot emphasize too strongly—has been the work of stamping our several outbreaks of foot-and-mouth disease and protecting the country against new invasions of this foreign infection. We are one of the few great nations of the world free of this terrible livestock scourge.



Left to right: Dr. A. Eichhorn, retirement from B.A.I. effective Oct. 31, editor; Prof. Dr. Rudolph Manninger, co-author; Prof. Dr. Joseph Marek, co-author; Dr. John R. Mohler, retirement from B.A.I. effective July 31, editor, and Dr. J. Russell Greig, editor-in-chief of the Fourth English Edition of Special Pathology and Therapeutics of the Diseases of Domestic Animals. Photo taken at 13th International Veterinary Congress, Interlaken, Switzerland, 1938

This is due to the eternal vigilance of the doctor and his associates who took prompt and effective steps to suppress the disease every time it appeared and who have taken the necessary precautions against the importation of infected animals or products from foreign sources. We haven't had an outbreak of foot-and-mouth disease since 1929.

Under Doctor Mohler's supervision, the original anti-hog-cholera serum—developed through Bureau research—has been improved in purity and effectiveness. We could not possibly have our present tremendous production of hogs if this safeguard were not available. The control of hog-cholera relieves farmers of their greatest element of risk in hog production. It is a protection almost beyond calculation in value.

Another accomplishment of tremendous importance has been in the field of meat inspection. This work, highly developed under the chief's supervision, guarantees the wholesomeness and freedom from disease of all meat moving in interstate commerce. Consumers now take for granted the wholesomeness of U. S. inspected meat. Back of that standard of purity and quality is a rigid system of inspection that reaches the bulk of our meat supply.

Still another great accomplishment—much of it under Doctor Mohler's direction—has been the work of eradicating cattle-fever ticks in the South. This was begun in 1906 and is now more than 99% complete. A like project involving many years of patient research and a nation-wide control program is aimed at stamping out brucellosis or Bang's disease in cattle. This is now well advanced.

Along with the great advances in livestock disease control have been many outstanding achievements in breeding. Experiments covering many years and a great number of generations of animals have shown the way to improved types of animals and poultry. This work has given the country better and more efficient producing animals—a significant development under present conditions when large production of livestock products adds to our fighting power.

We are greatly indebted to Doctor Mohler for these and many other fine accomplishments. Not only this Nation, but the world recognizes the great advance of the Bureau of Animal Industry under his leadership.—*Claude R. Wickard,* Secretary U. S. Department of Agriculture.

★ ★ ★ BUY WAR SAVINGS STAMPS AND BONDS

Milk and its products comprise more than 25% of the 1500 pounds of principal foods consumed each year by the average American.—*Certified Milk.*

Veterinariorum Seniores

Two British veterinarians, S. L. Hames, M.R.C.V.S. and William Anderson, M.R.C.V.S. were graduated from the Royal Veterinary College (London) 70 and 69 years ago respectively. Both are still active. The late Dr. C. W. Crowley of St. Louis was graduated 68 years prior to his death, which occurred a few months ago. Prof. W. L. Williams who is active in veterinary research was graduated 64 years ago.

Trust in Veterinarians

If we would sail the seven seas without inviting disaster, we must man our ships with skilled mariners; if our transcontinental or transoceanic planes are not manned by the most highly trained pilots, we again invite disaster; if we entrust the health of our livestock to other than those skilled in the preservation of the health of our domestic animals, the veterinary profession, we violate the dictates of wisdom just as much as if we trusted our ships and planes to be manned by novices.

During the period from 1917 to 1940, while the cattle tuberculosis eradication campaign was in progress, the biologic tuberculin was restricted (and rightly so) to use by veterinarians exclusively. The project, being one properly within the domain of the veterinary profession, was not permitted to be tampered with by non-veterinarians. No project in animal-disease-control was ever so triumphantly put over.

It is with no small amount of pride, a pride which all will doubtless grant is both justifiable and pardonable, that that part of the meat-packing industry operating under Federal inspection now boasts a small part in putting over this cattle tuberculosis eradication project.

This particular section of the packing industry early cast its lot and a considerable amount of cash into this undertaking, believing, apart from most others, that the huge task of tuberculosis eradication in cattle was not beyond a reasonable possibility of accomplishment when entrusted to a veterinary profession that had already proved itself signally proficient in the eradication and control of other animal diseases.

Faith in the Profession

Surely the monetary investment that this part of the packing industry made in this livestock enterprise should be accepted as indisputable evidence of its implicit faith in the veterinary profession to put its job over in a big way.

For fear there are some yet who are uninformed as to how this part of the meat packing industry went about contributing cash to this cattle tuberculosis eradication project, it may not be out of place to describe the manner of the contribution. Whenever a county became a modified accredited area (where cattle tuberculosis had been reduced to one-half of one percent, or less), this section of the packing industry paid a premium of 10c per hundred over the current market price of hogs for hogs originating in such counties.

By this means other counties were encouraged to have their cattle tested and thus avail themselves of the premium paid for hogs in the accredited counties. It seems there is a lesson to be learned from this greatest-of-all successes in the interest of the cattle industry; i.e., when the legitimate interests of the veterinary profession, and the legitimate interests of the packing industry, are cooperatively pooled in the interests of the livestock industry, great things for the good of the livestock industry may be expected to happen.

Allied Interests

The interests of the veterinary profession, and those of the packing industry, are so closely akin that when any break in our concordant relations occurs, there is evidence that one or the other of us has outraged legitimacy. For the good of all concerned, let us keep the direction of our common interests headed toward legitimate goals, and then rest assured that the greatest good to all will be the outcome of our common unselfish, but purposeful, endeavor. —*H. F. Veenker, General Superintendent, John Morrell and Company, Ottumwa, Ia.*

Problems in Meeting The 1943 Goals for Animal Production

IF THE production goals for meat, milk and eggs are to be attained, the animals that produce them will have to be fed adequately. In other words, human foods in form of animal products cannot be made available unless the animals are provided adequate feeds to produce the meat, milk and eggs. In that sense, feed precedes food.

The war has brought about several critical feed problems. These problems concern quantity or amount and quality or kind of feed ingredients available in terms of needs.

The reduction in the available supply of animal and fish protein concentrates has not only created a protein but also a mineral and vitamin problem. It is known that animal and fish protein concentrates contain proteins of better quality of higher feeding value than those of plant origin. At the same time, the animal and fish protein concentrates supply essential minerals such as calcium and phosphorus and also contain a higher proportion of some of the essential vitamin B complex factors than do the plant protein concentrates. Thus when animal or fish protein concentrates are replaced from plant protein sources, it immediately becomes not only a problem of protein quality but a vitamin and mineral problem as well, with the more critical animals—swine, poultry and young calves.

In case of ruminants, the quality of protein, vitamin B complex factors, or the higher percentage of minerals in animal or fish protein concentrates are not a problem. The protein problem in ruminants is chiefly one of the amount of materials available. However, in case of the young calf, in which the rumen has not fully developed, the quality of protein, vitamin B complex, and minerals *are* a factor. If the usual supply of milk fed to calves up to six months of age is decreased, because of diversion to human needs, certain critical materials (protein, vitamin and mineral supplements) must be made available to take the place of the milk.

The most satisfactory plant protein concentrate to take the place of animal or fish proteins in swine and poultry feeds is properly processed soybean oil meal. However, for best results in terms of efficiency, some animals or fish protein must be included in the ration. Other plant protein concentrates require the use of larger amounts of animal or fish proteins if the final feed or ration is to prove adequate and efficient.

The need for animal, or fish protein, is particularly indicated in chick and turkey starter feeds, poultry and turkey breeding feeds, breeding and lactating feeds of swine, calf feeds, and the feed of young pigs, particularly up to around 75 pounds in live weight.

Replacing the animal or fish protein concentrates with soybean or other plant protein, will necessitate the use of additional calcium and phosphorus supplements and of products which supply the vitamin B complex factors such as milk products, good quality alfalfa meals, dried yeast, or fermentation and distillation residues which contain these factors. Thus by using liberal amounts of plant proteins in place of animal or fish proteins in swine and poultry feeds, the needs for increased amounts of bone meal or its equivalent and supplements containing the vitamin B complex factors are increased. For example, recent work has shown that replacement of tankage in swine rations with soybean meal requires not only the addition of minerals but also requires raising the level of alfalfa meal from around 5 to 10 or 15% to obtain satisfactory results in dry-lot feeding.

It should be noted that poultry, in particular, have additional reuirements for riboflavin and associated factors aside from these arising or created by substituting plant for animal or fish proteins. Under ordinary conditions, the supply of milk products, liver meal, and alfalfa meals have been adequate to meet the demands. However, the diversion of milk to human channels and the cutting off of imports of liver meal plus the increased feed needs to meet production goals for meat and eggs have

caused a serious shortage of these products. Although certain fermentation and distillation by-products containing the vitamin B complex factors of milk are available and are being used, the supply of these products plus those of milk, whey and alfalfa are not adequate to fill the needs.

Alfalfa meal is also an important ingredient in supplying the vitamin A needs of poultry and swine, especially in cases where the animals are not on pasture. In the event the supply of vitamin A from fish oils becomes limited, the importance of high vitamin A meals in poultry feeds becomes of paramount importance.

The feed industry is rendering a necessary and highly effective service by supplying efficient complete feeds to the feeder and should be aided in its efforts to supply the feeder with feeds essential to meeting the production goals.—From an address by R. M. Bethke, Ohio Agr. Exp. Sta. at a meeting of the Planning Committee of the feed industry, Buffalo, N. Y.

Estimated Waste of Edible Meat in Marketing Livestock in the United States

Dead and Crippled Animals	25,000,000 pounds
Bruised Meat Trimmed Out	25,000,000 pounds
Cattle Condemned for Tuberculosis under Federal Meat Inspection 1,593 Carcasses, average weight 520 pounds each	828,360 pounds
Cattle Condemned for Tuberculosis under State and City Inspection	171,640 pounds
Hogs Condemned for Tuberculosis under Federal Meat Inspection 13,357 Carcasses, average weight 176 pounds each	2,350,830 pounds
Hogs' Heads, Hearts and Livers Condemned for Tuberculosis under Federal Meat Inspection on 399,136 retained	5,987,040 pounds
Hog Carcasses, Heads, Livers and Hearts Condemned for Tuberculosis under State and City Inspection	2,662,130 pounds
Beef Livers Condemned for Abscess, Flukes, etc., under Federal, State and City Inspection	19,000,000 pounds
Beef Carcasses Condemned for Pericarditis (Inflammation of Heart Membrane) from Metallic Objects in Stomach	2,600,000 pounds
Beef Trimmed Out Around Grubs in Cattle Hides	11,500,000 pounds
Total	95,100,000 pounds

This waste of 95,100,000 lbs. of edible meat is sufficient for 260,274 men in our armed service for one year at the present allowance of 1 lb. of meat each per day.

It is a waste that should have the full consideration and active co-operation of all identified with the livestock industry in efforts to reduce it.

The above statement does not include the losses on condemnations for pneumonia, cholera and arthritis and from disease on farms in the United States which is impossible to estimate accurately.—Report, 1942, *National Live Stock Loss Prevention Board.*

Administration of Essential Amino Acids to Maintain Nitrogen Equilibrium

It has been demonstrated[1] that a mixture containing all the essential amino acids can be administered parenterally and substituted for protein in the diet and thus maintain the nitrogen equilibrium of the patient.

Clinically[2] the ingestion of protein nitrogen in the form of amino acids gave better results than did a high protein diet. When administered intravenously the amino acid solution was diluted in two or three parts of isotonic solution of sodium chloride. Injection of the amino acid solution into the bone marrow proved satisfactory. The amino acid solution diluted with fruit or tomato juice given orally was as effective as intravenous injections.

In operative cases, such as gastric surgery, when patients many times can take no food by mouth for considerable periods, adequate nutrition may be maintained by parenteral use of amino acid solution and 10% dextrose.

[1] Altshuler, S. S., H. M. Hensel and Melville Sahyun, 1940. *Amer. Jnl. Med. Sci.* 200:239.

[2] Altshuler, S. S., M. Sahyun, H. Schneider and D. Satriano, 1943. Clinical use of amino acids for the maintenance of the nitrogen equilibrium. *Jnl. A. M. A.* 121:3, pp. 163-167.

Horse Facts and Figures

By F. B. HADLEY*
Madison, Wisconsin

More and Better Horses

THE farm horse is still considered indispensable by the great majority of farmers, including those who also have tractors for the heaviest work. Presumably more horses will be needed in 1943 to furnish farm power and for delivery purposes in the cities than in 1942 because of wartime restrictions on the sale of new tractors and on the use of rubber and gasoline.

Origin and History of Horses

There were no horses in North America when the continent was discovered by white men, but fossils indicate that the progenitors of the modern horse existed here about 60 million years ago. The pre-historic American horse had four complete toes on the front foot and three toes on the hind foot. The animal was about the size of a fox terrier and is known as the eohippus which means dawn horse. Bones of prehistoric horses have been found mingled with human remains in South America but not in North America.

All present day horses in the Americas are descendants of those imported from Europe. Wild horses, called mustangs, still roam the mesas of certain western states. Mustangs with indomitable spirit are known as bronchos. They are not a distinct breed.

Numbers and Uses of Horses

According to the census of 1940 there were 14,602,000 horses and mules in the United States. They were valued at $1,155,000,000, or approximately $80 each.

Horses and mules furnish all the power on 75% of the six million farms in the United States and part of the power on most of the others.

Horses were used for food by man long before he domesticated them for warfare, power and transportation. Horse meat is dark in color, coarse grained, sweet and, except that from young horses, is tough. Horse meat is commonly canned or dried as a food for dogs and is fed raw to carnivorous animals in zoos and on fur farms because it is cheap, wholesome and nutritious. The fur farmers of Wisconsin alone feed the carcasses of about 8,000 horses yearly.

The hide from the horse's rump when tanned makes the high-grade shoe leather known as cordovan, while the long hairs of the mane and tail are used in bows for musical instruments, in hair cloth, and as surgical sutures.

The remount service of the Army during the fiscal year 1941 purchased for military purposes 22,720 riding horses, 1,333 draft horses and 4,096 pack mules—a total of 28,149 animals.

A good type army remount

In England the home guard is using more and more horses in place of motors for patrol work, because of their silence and their mobility in lonely, rough country.

Characteristics of Horses

The horse is distinguished from the other existing members of the genus Equus and family Equidae by the long hair of mane and tail, larger size, larger hoofs, more arched neck, small head and short ears.

The foal is born with a full coat of hair, no front teeth, as a rule, and eyes open. It is able to get up and start nursing within 30 minutes after birth. The horse sheds his body hair twice a year. The mane and tail are permanent.

During the winter months horses in a cold climate grow a long, lusterless, rough and bristling hair coat, if not groomed regularly, but this does not necessarily indicate poor condition.

*Professor of Veterinary Science, University of Wisconsin.

The horse has more gaits than any other animal. They are the walk, trot, pace, amble, rack, gallop, canter, jump, running walk, fox trot, stepping pace and traverse or side step. Some of these gaits are natural; others are acquired by education or schooling. Horses that pace naturally are homozygous recessives and breed true.

A horse has been known to live until 58 years of age, but the average span of life is much shorter.

The largest horse on record, a Belgian stallion, was said to weigh 3,030 pounds, to stand 19½ hands high, and, to have a girth measure of 10 feet and two inches. The height of a horse is always measured in hands—four inches.

The horse's red blood-corpuscles are smaller than those of man. The coagulation time of horse blood is more than twice that of man. Six quarts of blood can be drawn from the jugular vein of a 1,000 pound horse without ill effect. The blood serum contains a number of substances used for medicinal purposes by both physicians and veterinarians.

Horses may void as much as ten quarts of urine in 24 hours. Horse urine is turbid and somewhat slimy and on standing deposits a heavy sediment. It is alkaline in reaction (pH 8.3).

Foals at birth usually weigh from one-twelfth to one-tenth as much as their dams. They often make more than one-half their entire growth during the first year.

Mare's milk on the average tests only 1.15% fat. It contains more sugar but less protein than cow's milk.

Horses are creatures of habit and dislike changes, but readily become accustomed to a new environment. They thrive better kept together than when alone and enjoy each others company because they are by nature gregarious. Horses have been known to die as a result of loneliness.

The horse has highly developed senses of touch, hearing, sight and smell. He lacks the power of reasoning. Horses vary considerably in the degree of intelligence they possess. If blindfolded and taken into a strange country at night, the horse can find his own way home. They apparently can sleep with their eyes open and can swim the first time in water.

A mare usually gains 150 to 200 pounds in weight during pregnancy. Twins and triplets are rather rare

The horse cannot breathe freely through his mouth, because his soft palate is too long and, as a rule, he is unable to vomit. In event he does vomit the dejecta comes out through the nose.

Among the common vices of horses are: kicking, biting, pawing, striking, switching, line hugging, balking, backing in harness, shying, running away, weaving, halter pulling, rolling, crowding and cribbing or wind-sucking.

Facts About Horse Anatomy

Horses have no collar bone, or clavicle, between the breast bone and shoulder. The skeleton consists of 18 pairs of ribs, 8 of which are true and 10 false. The vertebral column is composed of from 51 to 56 bones grouped as follows: neck 7, back 18, loin (lumbar) 6, croup (sacral) 5, and tail 15 to 20. The Arabian horse has only five lumbar vertebrae, all other breeds have six.

The horse has a peculiar pouch contain-

ing air on the course of the tube between the pharynx and middle ear. He also has a unique false nostril, or blind pocket, lined with hair and situated just above the true nostril and the largest eye of any land animal.

The nerves in the upper lip of the horse assist the animal to discern by the sense of touch what substances are suitable to eat.

Horses have two sets of teeth—the milk set which are 24 in number, and the permanet set of 36 in the mare and 40 in the stallion. The horse's teeth wear away gradually and in old animals may become quite loose in their sockets. Some horses have "wolf teeth" but they are of no significance and they sometimes develop dentigerous cysts at the base of the ears, more rarely in the testicles, containing many vestigeal teeth.

The horse's stomach lining is distinctly divided into two areas—one white, and the other reddish in color. The stomach is small and cannot hold as much water as is drunk at one large draft.

The intestines of the horse are 100 feet long. The cecum, shaped like a large inverted comma, is about three feet long, has a capacity of about seven gallons and has a blind end.

The horse has no gall bladder. His kidneys have a smooth surface; the right is heart shaped; the left bean shaped.

The horse's hoof consists of three distinct horny parts of different texture, viz., the wall, the frog, and the sole. A horse can grow a complete hoof in eight months.

Breeding Principles

Mares reach puberty at about 10 months of age at which time they come in heat for the first time. They should not be bred, however, until they are two or three years of age. The duration of the heat period is six to seven days and is repeated every three weeks. The so-called "foaling heat" occurs between the third and seventeenth day after the foal is dropped. The gestation period averages 337 days.

The mare often gains 150 to 200 pounds in weight during pregnancy. After the third month she becomes less active and more docile and as a rule gives birth to only one foal, rarely twins. Twin foals are often aborted, born dead or so weak that they survive only a short time.

Mares may be artificially inseminated, but the practice is attended with more disadvantages than in the cow.

The sire exerts no greater influence on the foal than does the dam.

Feeding Suggestions

The horse is a herbivorous animal, and will rarely eat meat, cooked or raw. He is quite fastidious about his food—using his senses of smell, touch and taste to distinguish between the foods he likes and those he dislikes. Draft horses at hard work require at least one pound of grain per day for each 100 pounds of live weight and although they are unable to digest more than 30% of the combustible materials they convert forage and pasture crops into power very efficiently. The amount of green grass that the horse can eat in 24 hours is astounding. However, this is understandable when the water content (70 to 75%) of grass is considered. Horses require plenty of salt and water in hot weather to replace the large amounts excreted in sweat. As a rule, the ration of the farm horse does not need to be supplemented with minerals or vitamins.

Common Diseases of Horses

More horses die from digestive disturbances than from all other causes combined. New-born foals are very susceptible to infections of the naval. Equine encephalomyelitis is an infectious virus disease often transmitted by mosquitoes. It can be prevented through vaccination with chick embryo vaccine.

Horse distemper, or strangles, is an acute, contagious disease especially of young animals. Although they are more susceptible to tetanus than any other animal, fortunately, they can be protected by vaccination with tetanus toxoid.

Horses are subject to the following common diseases affecting the bones: spavin, splint, ringbone, sidebone, osteoporosis and osteomalacia.

Like all warm-blooded animals, horses readily contract rabies through the bite of a rabid animal.

Horses are often poisoned by eating

spoiled silage; rarely by poisonous weeds, loco weed excepted.

All horses harbor worms of some kind in their intestines. These worms lay eggs which can be detected and identified by a microscopic examination of the feces. Foals as a rule become infected with the very slender thread worm about one month after birth. This worm disappears by the time the animal is one year old. The large round worm (Ascaris) may be present at any age.

When a horse, accustomed to daily work, is exercised after one or two idle days on full feed, he is susceptible to a noncontagious disease called azoturia, which occurs in no other animal.

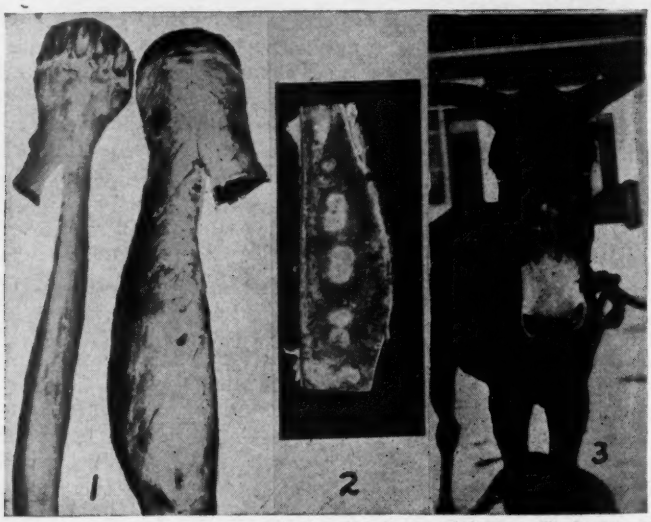
Buying Horses

Horses are selected by intelligent buyers on the basis of their style, disposition, quality, bone, feet, constitution, proportions, breed characteristics, age and soundness.

Horses offered for sale should be examined (1) in the stall, to detect vices; (2) when backing out of the stall, to detect imperfect control of the legs and other nervous disorders; (3) in motion to test their wind and way of going. The examiner will view the animal in profile from in front and behind, from the right and left sides, and obliquely forward and backward. The horse should be harnessed and hitched to test his reliability before being purchased.

Mules and Jacks

The mule is a hybrid resulting from a cross between a jackass, commonly called a "jack" and a mare. The female ass or "jennet" may conceive from service by a stallion. The offspring is known as a "hinny," which resembles the horse rather than the mule and like the mule is seldom if ever able to reproduce.



Osteomalacia is one of the common diseases affecting the bones of horses. (1) Section of left ramus of bone. Note pale strip of fat between medial cortex and teeth. (2) Horizontal ramus and body of mandible showing the enlargement of osteomalacia. Normal bone on left. (3) Mule affected with "big-head." Note swelling of maxillae

The jennet carries her young approximately 12 months as compared with 11 months for the mare. Twin mule foals are exceedingly rare, but two such occurrences were reported in 1942.

The mule is said to have more eccentricities and undeniable virtues than any other domestic animal.

"The mule has been stigmatized as a 'creature without pride of ancestry or hope of posterity,' but he is an exceedingly respectable servant of the Lord of Creation." —*Sigler.*

Mules will seldom eat grain when hot and tired, thus exhibiting more sense than most horses—and some men.

Artificial Insemination*

By S. L. HIGNETT, B.S.C., M.R.C.V.S.
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ARTIFICIAL insemination is the collection of semen from the male and its introduction into the female genital tract by means of instruments so that no direct contact between male and female animals is needed for breeding purposes.

There is nothing new about artificial insemination. For centuries (probably dating back before the Christian era) it was practiced by Arabs in connection with horse-breeding. Much later, in 1780, Spallanzani took semen from a dog and with it successfully impregnated a bitch. Hunter and Howe (1799) and Sims (1866) employed artificial insemination to overcome infertility in human beings. For a great many years now it has been employed by veterinary practitioners to overcome certain types of infertility, particularly in mares. As a result of the great improvement in our knowledge and in the apparatus employed, insemination can now be carried out with far greater certainty, with far greater safety and with the male and female hundreds of miles apart.

Modern improvements are in large part due to the work of Professor Ivanoff in Russia. His experiments started in 1899 and were at first confined to horse-breeding. They continued until the outbreak of the last war. Afterwards the Russian Government, recognizing the potentialities of the work, retained Ivanoff and established in Moscow an experimental laboratory for artificial insemination. Excellent work has been done there and artificial insemination on a large scale has been widely employed in the U.S.S.R. In 1930 some 60,000 mares, 20,000 cows and 100,000 ewes were artificially inseminated; in 1938 the figures had risen to 120,000, 1,500,000 and 14,500,000, respectively. In 1938, from one bull 1,536 cows were inseminated and produced 1,490 calves, whilst from one ram 15,016 ewes were inseminated and produced 15,662 lambs. Artificial insemination has been widely practiced in Denmark, Holland, Italy and U.S.A., and in our colonies, especially Kenya. Reports arriving through neutral sources indicate that it has been used in Germany to an increasing extent since the outbreak of the present war. From 1935 onwards research work has been carried out at Cambridge and has chiefly embraced the storage and transporting of semen.

Now what are the advantages to be expected from artificial insemination?

1. In countries such as Kenya, the Argentine and the U.S.S.R., where high-class bulls have to be imported, the advantages of artificial insemination are obvious when we remember that one bull can be used to inseminate 1,000 or more cows annually.

2. In this country artificial insemination would have the very great advantage of bringing the proven sire within the reach of the small farmer. In this respect it would be the biggest step forward since the introduction of the system of pedigree breeding.

3. It would do away with second-grade bulls. Breeders would of course lose their market for such animals, but they would find (as the Danish breeders found) that there would be an increased demand for top-class sires.

4. Fewer bulls will be needed and there will be a consequent saving in feeding stuffs—an important point in war-time.

5. There will be less risk of spreading certain venereal diseases of cattle. This will apply particularly to trichomoniasis.

6. Since the bull's semen will be examined regularly there will be a check on the bull's fertility. It is fairly common for a bull to become less potent and perhaps quite infertile, and where natural service is employed such a deterioration might not be detected for some time so that valuable months are lost.

7. It is easier to employ female labor on farms where no bull is kept.

8. There is a saving of the time taken up by driving cows from one holding to another where a bull is kept.

9. There is the advantage that artificial insemination will mean that better breeding and calving records will be kept.

10. Artificial insemination is perfectly

*Address to the South-Eastern Division, N.V.M.A. Reprinted from *Vet. Rec.*, 55:5, pp. 55-56.

safe and observations made over several generations indicate that when the operation is performed by a skilled worker no harm is suffered by parents or progeny.

11. Reasonable in-breeding can be extended. The breeding of purebred animals will be greatly increased. We must remember that at present only one-third of the bulls used are purebred and even fewer cows can claim that distinction.

12. It will be possible to mate outstanding individuals which are hundreds of miles apart.

13. After the war, if artificial insemination has already been established in this country, we might find we have a valuable export trade in semen. If we are not prepared America may anticipate this demand and capture the market.

Now for the other side of the picture.

1. From the point of view of getting cows into calf, artificial insemination is no better than natural service.

2. It is not a panacea for breeding troubles. The cow suffering from endometritis is no more likely to be settled by artificial insemination than by natural service.

3. Artificial insemination will probably prove more expensive for the smaller farmer who ordinarily uses his neighbor's bull at the small fee which commonly prevails.

4. Where no bull is kept on a farm it is sometimes more difficult to ascertain whether a cow is in heat during the winter.

5. One must consider the use of petrol and man-power entailed in running an artificial insemination scheme.

6. Some breeding establishments will suffer through decreased demand for their second-class sires.

7. It has wrongly been suggested that artificial insemination will lead to in-breeding. A large number of bulls would be employed at the various centers and precautions would be taken to see that a bull did not fertilize his own daughters. If one bull were kept he would not be retained for more than two years; if two bulls were kept they would be retained for a period not exceeding four years. If intended for further breeding they would then be sent to another center.

Collection of Semen

The most important and at the same time the most difficult operation connected with artificial insemination is the actual collection of a satisfactory sample of semen. Semen can be collected in a number of ways:—

1. A female may be served and semen collected from the vagina. Such a sample is probably contaminated and is diluted with vaginal secretions which have a deleterious effect on the spermatozoa and render the semen difficult to handle.

ARTIFICIAL INSEMINATION EQUIPMENT
Included are: artificial vagina, vaginal speculum, glass insemination tube, all-glass syringe, chemical thermometer, semen vials, finger cots, semen diluting fluid, thermos bottle, lubrication jelly, obstetrical sleeve, rubber gloves and carrying case.—*Courtesy Jensen Salsbery Laboratories*

2. A sponge is inserted in the vagina, the female is mated, the sponge removed and the semen squeezed out. This method has the disadvantages that the spermatozoa are injured in the process, the sponge is difficult to sterilize and only a fraction of the semen is recovered. This method has been employed chiefly in the mare.

3. In the case of most bulls, semen can be obtained by rectal massage of the seminal vesicles and the vasa deferentia. There may or may not be protrusion of the penis; in the latter case the semen dribbles away from the sheath. The first fluid collected consists of secretion from accessory glands, followed by a concentrated suspension of

spermatozoa. Not all bulls respond to this treatment, moreover any semen which is obtained is likely to be contaminated.

4. Ejaculation has been promoted in rams by electrical stimulation, a current being passed between the rectum and the lumbar region.

5. In Germany Götze has collected semen from the stallion by means of the condom, but for obvious reasons such a method is not applicable to the bull.

6. A sperm collector consisting of a rubber sac which fits the vagina and is held in position by an inflatable rubber ring, has been utilized in bovines. The collector is placed in position, the cow is served, the collector is then removed and the semen poured into a glass receptacle. When using this method there is always a risk of the bull's penis being thrust between the collector and the wall of the vagina.

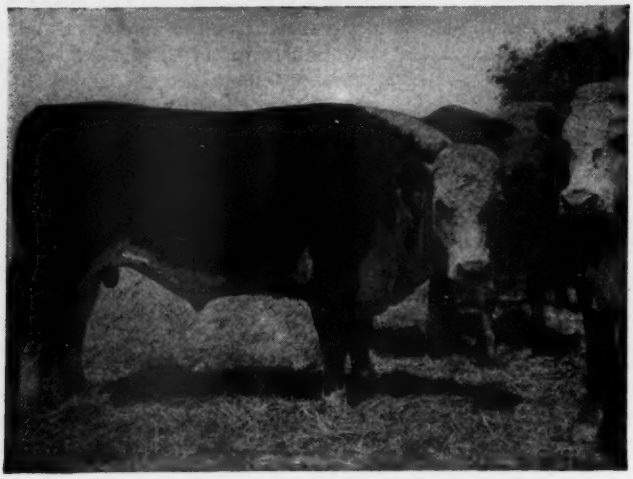
7. The best method of collecting semen is undoubtedly by means of the artificial vagina which is used for the stallion, bull and ram. The following description refers to collection from the bull.

There are several patterns of artificial vagina on the market but for the bovine the handiest is probably the Russian model. This consists of a hard rubber or metal tube with a soft rubber lining slightly thicker than the inner tube of a bicycle tire. Before assembling the artificial vagina the worker must ensure that the hands are clean and dry. The ends of the soft tube are turned back on the ends of the outer tube and fixed in position by binding with soft cord. By varying the amount of turnover the tension of the inner tubing can be adjusted. The outer tube has a hole (fitted with a stopper) through which water can be poured into the space between the outer and inner tubes. A graduated glass receptacle fits into one end of the artificial vagina, and a metal cage may be fitted to protect the glass.

The inner lining should be adjusted, the stopper removed and the space between outer and inner tubes filled with water at 55° C. (131° F.) from a kettle, the vagina being held in the horizontal position. The stopper is inserted. A clean dry thermometer is placed in the end of the artificial vagina furthest removed from the stopper. By means of a clean glass rod the whole of the inner surface of the vagina is smeared with sterile vaseline. Some use liquid paraffin instead of vaseline, but the latter is preferable in practice. Sterile liquid paraffin (2-3cc) is, however, placed in the glass receptacle before the latter is fitted into position. The thermometer should register a temperature of 42 to 45° C. (107-113° F.) If the temperature is outside this range one must allow the water to cool or empty out some of the water and replace with hot water from the kettle, to adjust to the required temperature. Finally, the pressure exerted on the lining must be adjusted by holding the vagina in the vertical position with the mouth downwards and opening the stopper, when any surplus water will run away. The stopper is replaced and the apparatus dried with a clean cloth.

When the apparatus is ready the bull is led to the selected cow which may or may not be in estrum. In the latter case an older cow is preferable; she is tied up loosely to a ring and is restrained by a man standing on either side of her. The collector holds the artificial vagina mouth downwards in his right hand and stands on the right side of the cow. Then the bull mounts, the apparatus is held behind the bull's foreleg and at an angle of 45°, with the mouth pointing downwards towards the bull's penis. The penis is directed into the the vagina by the operator holding the prepuce with his left hand. Care must be taken not to handle the penis itself as this causes the bull to retract. As soon as the artificial vagina is entered the bull thrusts upwards and ejaculates. The artificial vagina should immediately be turned mouth upwards. The semen runs down into the glass receptacle and is covered and protected by the liquid paraffin. The receptacle is removed from the end of the vagina and stood upright in a wooden block. A bull should ejaculate from 2 to 8cc of semen. If the bull has not been used for a week or so a second ejaculate should be collected and used for insemination. The artificial vagina can be fitted in a dummy or "phantom" cow.

Healthy bull semen is a thick milky suspension, whilst a poor sample appears to be watery. An excessive yellowish color denotes the presence of pus. Apart from naked-eye appearance semen can be examined microscopically for motility and condition of individual sperm (abnormal spermatozoa should not exceed 10%) and more especially for the presence or absence of the wave movement of the spermatozoa. Other important tests are sperm count, using a hemocytometer (average should be about 800,000 per cmm), *p*H test (should lie between 6·8 and 7·2) and respiration test. This latter test is based on the fact that spermatozoa utilize oxygen and the amount taken up is a measure of the sperm activity.



In 1938 in the U.S.S.R. 1,536 cows were inseminated from one bull—these cows produced 1,400 calves

The cow to be inseminated has its vulva and perineum carefully washed, using plain water. The vagina is dilated by means of a tubular or Russian speculum and ½ to 1cc of semen is introduced into the cervical canal, using an inseminator. Quite an effective instrument consists of a 1cc all-glass syringe fitted with a vulcanite extension.

If the semen has to be transported or stored it is pipetted into small glass tubes (sufficient semen for one cow in each tube). The space above the semen is occupied by sterile liquid paraffin and the tubes are stoppered. These small tubes are then wrapped in cotton wool and placed in a larger corked tube which is immersed for 30 minutes in water cooled with ice and afterwards this large tube is stored in a thermos flask containing chipped ice. In this way semen can be stored up to 72 hours. When being transported the thermos flask can be surrounded with corrugated cardboard or packed in a box containing cotton wool or wood shavings. When required for use the large tube is removed from the thermos flask and allowed to stand at room temperature for 30 minutes.

A fairly recent development is to place sufficient semen for one cow in a gelatine capsule. These copsules are coated with wax and when required for use they are inserted into the cervical canal by hand or by means of a special gun. More recently semen has been actually incorporated in gelatine pessaries.

Where a large number of animals are to be inseminated from one ejaculate the semen can be diluted. Various diluents are used, a suitable one consisting of a glucose-phosphate mixture, one part of semen being diluted with an equal volume of the diluent. At the present time there is no call for diluting semen in this country.

An insemination center should serve a radius of 10 to 15 miles and one bull should be allowed for every 1,500 cows. Semen would be collected early in the morning and the requests for insemination should be received by 10 a.m. when the inseminator would set out on his rounds. He would take extra supplies of semen so that he could, where practicable, deal with any requests received at previously selected points on his route. Cows coming into estrum in the evening can be inseminated the next morning.

The Effects of Sulfaguanidine and Sulfasuxidine in a Natural Outbreak of Ovine Coccidiosis

By PHILIP A. HAWKINS[1], C. L. COLE[2] and FRANK THORP, JR[3].
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COCCIDIOSIS is a disease which resists successful treatment. No therapeutic agent now known is able effectively to interrupt the life cycle of these parasites once they become established in the animal body. Until recent years, before the introduction of elemental sulfur and sulfaguanidine, no drug was known which was a prophylactic against infection. Recent work on ovine coccidiosis [4, 5] indicates sulfaguanidine may exert the same coccidiostatic effect in sheep as has been noted in poultry and, in addition, may possibly exert some beneficial effects in cases of clinical coccidiosis. The purpose of this paper is to record the results of the administration of two sulfonamides in a natural outbreak of coccidiosis in lambs.

History

The lambs used in this experiment were Hampshires, one to two months of age, and a part of the flock maintained at this station. The ewes were included in anthelmintic investigations during the past winter and were relatively free of cestode and nematode infections. However, 100% of the ewes were carriers of one or more species of the following coccidia: *Eimeria arloingi, E. faurei, E. pallida, E. parva, E. nina-kohlyakimovi* and *E. intricata*. The conditions under which the flock was maintained were excellent. The bedding was deep, and was removed at frequent intervals. If it became damp, it was replaced with clean dry straw.

After an unseasonal warm spell in the early spring, a number of lambs began to show a diarrhea, loss of appetite, gauntness and dehydration. One of these lambs was subjected to necropsy and a diagnosis of coccidiosis was made. The percentages of the various species of coccidia present was as follows: *Eimeria arloingi*, 57; *E. parva*, 23; *E. pallida*, 16; *E. faurei*, 3; *E. nina-kohlyakimovi*, 1; *E. intricata* was present in small numbers.

Methods

The lambs in the first group were divided into three lots; two were treated and one remained as an untreated control. Lot I (four lambs) was kept as controls; Lot II (seven lambs) was kept in the same pen as Lot I and received one gram daily of sulfasuxidine (succinylsulfathiazole) as a drench; and Lot III (13 lambs) in the adjoining pen was given approximately 0.1 gram per kilogram of sulfaguanidine daily in the grain. A week later lambs in another wing of the barn began to show evidences of coccidiosis. These were divided into two groups, Lot IV receiving sulfasuxidine, and Lot V, sulfaguanidine in the dosage noted above. No attempt was made to clean the pens or segregate the infected animals, as fecal examinations showed the infection to be present in the entire flock. Furthermore, it would have been practically impossible to clean the barns so as to destroy the coccidia already present, in addition to the millions being passed daily in the droppings.

Composite fecal samples were run from each group, dilution counts being made of the oocysts per gram of feces. The oocyst counts are given in Table I and Figure I.

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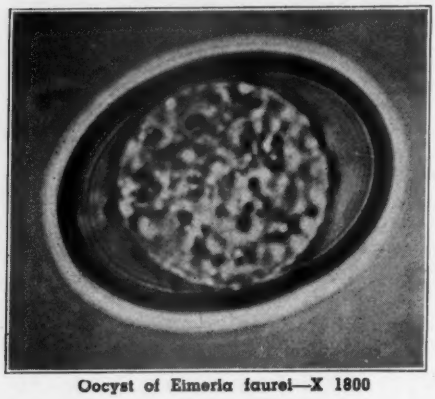
[2] Research Associate in Animal Husbandry, Michigan Agricultural Experiment Station.
[3] Research Associate in Animal Pathology, Michigan Agricultural Experiment Station.
[*] Journal article No. 647 (n.s.) of the Michigan Agricultural Experiment Station.
[4] Foster, A. O., John F. Christensen and Robert T. Habermann, 1941. Treatment of coccidial infections of lambs with sulfaguanidine. *Proc. Helm. Soc. Wash.*, 8, pp. 33-38.
[5] Christensen, John F., and A. O. Foster, 1943. Further studies with sulfaguanidine in the control of ovine coccidiosis. Vet. Med., 38, pp. 144-147.

There was no attempt made to differentiate the various species of coccidia present, each count representing only a gross count of all species.

Results

No lambs died of coccidiosis after treatment was instituted, although two from the Lot II given sulfasuxidine had died before treatment began. Lot II was the most seriously affected before treatment was instituted and showed the most marked response, as shown by the reduction in the oocyst counts and improvement in the physical condition of the animals. These lambs also showed the most marked reduction in oocyst counts during the first few days of treatment. Undoubtedly, several more lambs in this lot would have died if treatment had not been instituted. Lot III was not as seriously affected as Lot II, but the lambs in this lot showed the most marked improvement in their physical condition after treatment with sulfaguanidine was started. None of the controls in Lot I died, but their poor physical condition was such that even a month after the outbreak started, members of Lot I and Lots II and III could easily be distinguished. Regular oocyst counts of the three lots stopped after they had apparently leveled off. However, when an examination of the feces was made two weeks later there was a marked increase in the oocysts in Lot II and a slight increase in Lots I and III. Despite the marked increase in the oocyst counts at this time there was no change in the physical condition of the animals.



Oocyst of Eimeria faurei—X 1800

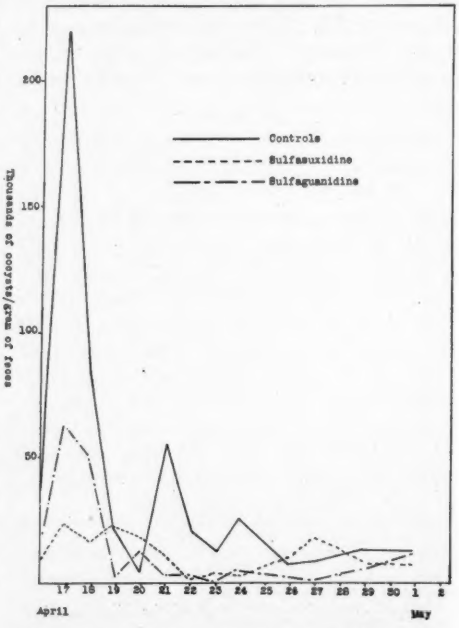
In the second group of lambs severe symptoms of coccidiosis were present when treatment was instituted. The oocyst counts likewise indicated that these animals were at the peak of their infection. In these animals it was not possible to run a control group, and, therefore, the oocyst counts are not tabulated. However, in Lot IV receiving sulfasuxidine there was marked clinical improvement, but no apparent effect on the oocyst counts. In this group after cessation of treatment there was considerable fluctu-

TABLE I—THE EFFECT OF SULFASUXIDINE AND SULFAGUANIDINE ON THE OOCYST COUNT IN OVINE COCCIDIOSIS

Date	Controls 4 Lambs (Lot I)	Sulfasuxidine 7 Lambs (Lot II)	Sulfaguanidine 13 Lambs (Lot III)
April 16	34,900	9,600*	13,300*
April 17	219,000	24,000*	62,800*
April 18	84,600	17,100*	51,700*
April 19	22,400	23,500*	3,000*
April 20	4,400	18,600*	13,800*
April 21	55,200	11,200*	44,900*
April 22	21,100	2,400*	3,900
April 23	13,100	4,500	1,200
April 24	26,200	3,300	5,000
April 26	7,600	11,360	3,500
April 27	8,600	18,800	2,800
April 29	13,200	8,900	5,400
May 1	12,900	7,400	11,600
May 13	8,310	63,900	22,500
May 15	30,200	52,000	10,700
May 17	12,000	8,400	11,200

*Days on which treatment was given.

Figure 1. Oocyst counts in treated and untreated cases of ovine coccidiosis.



ation in the oocyst counts, much greater than in Lot II. Lot V given sulfaguanidine showed the most rapid improvement clinically, accompanied by a rapid decrease in the oocyst counts with no upward fluctuation.

Discussion

The results of these experiments, although on a limited number of animals, indicate that both sulfaguanidine and sulfasuxidine are of some value in the treatment of natural outbreaks of ovine coccidiosis if treatment is instituted early in the course of the infection. The marked inhibition of oocyst production shows that these agents possess some action against the coccidia in the intestinal mucosa. Since large numbers of oocysts did not appear in the feces following the cessation of treatment, it is apparent that these drugs exert some lethal action during the time the drugs are being administered. It seems probable that the increased oocyst counts near the end of the observation period were due to reinfection, but that a sufficient resistance had been built up to protect the animals from further serious damage.

One point of interest is that the sulfasuxidine apparently has a greater effect early in the infection as measured by the oocyst production, whereas sulfaguanidine is more effective a few days later. Those lambs treated with sulfaguanidine were capable of maintaining a lower level of oocyst production after treatment ceased than did those on sulfasuxidine.

The results presented in this paper indicate that sulfaguanidine and sulfasuxidine markedly inhibit the production of oocysts by ovine coccidia. Both drugs are useful in alleviating clinical symptoms of ovine coccidiosis if treatment is started early in the infection. Treatment started later in the infection is not as successful but is of value.

Lambs ordinarily gain about one-half pound per day.

* * * *

The Period of Estrum in a ewe, normally lasts for about two days, and recurs every 16 days.

* * * *

One ram to every 30 to 50 ewes is considered sufficient in the breeding herd.

* * * *

The average duration of gestation in a ewe is 145 days or just under five months.

* * * *

Abortion is usually caused by injuries, fright, moldy feed; occasionally by infection—true contagious abortion. The best thing the practitioner can do in these cases, is to ascertain the cause, if possible; remove it, and advise a change of quarters and feed. Death of the ewe usually occurs from generalized septicemia, due to her weakened condition.

* * * *

Severe after pains may result in complete uterine eversion. To prevent eversion, stand the ewe with her head down hill, and give as a douche 20 drops of phenol in one gallon of lukewarm water. Also, hypodermially, give 100cc of calcium gluconate and dextrose solution with a one-twentieth of a grain atropin and lobelin. Keep the ewe standing with the head down hill.

* * * *

St. John's Wort is one of the most important of the poisonous plants so far as sheep are concerned. It grows on sheep ranges in northern California, and when eaten produces a blistering of the unpigmented skin especially if the animal be exposed to direct sunlight.

Death camass (*zygadenus venenosus*) abounds throughout the state in the open hill country and in the valleys.

Fit weed, found in northeastern California, causes much trouble.

These are but a few of the plants poisonous to sheep. In this brief discussion it is impossible to discuss all of them or all of the diseases encountered.

★ ★ ★ BUY WAR SAVINGS STAMPS AND BONDS

Veterinarians and the Cancer Problem

By Arthur H. Bryan, Major, V. C.
Baltimore, Maryland

FILTERABLE viruses have been tentatively classified according to their selective action on the various tissues of the body. Among these viruses are the dermatotropic, i.e., those having a selective action on and predilection for the skin. They cause benign papilloma or warts. Emulsions of warts, injected intradermally have produced warts in man following an incubation period of four weeks. In addition, veterinary viruses, whose pathogenicity is characterized by tumor formation, have been isolated—contagious epithelioma of chickens and myxomatosis of rabbits are examples.

Biotin-Cytolytic Growth Stimulation

A growth essential factor called biotin* which is present in co-enzyme R, has been proved essential to the growth of microorganisms. Recent research has suggested that biotin may be directly responsible for causing epithelial cells to undergo uncontrolled mitosis and hence, induce carcinomatosis. Biotin is a factor of the vitamin B complex so that an excessive intake of yeast, egg-yolk, pork and other foods rich in this vitamin may predispose to any condition for which biotin is responsible. Some years ago, a highly publicized theory accused milk of being a feeder for tumor cell formation. Statistics were gathered by proponents of this theory who endeavored to correlate excessive milk drinking nations and communities with a higher incidence of cancer morbidity. This theory may be revived, with the discovery that biotin, the cytological growth essential factor, is present in milk.

Avidin Therapy—Cytolytic Growth Inhibition

Avidin, which causes growth inhibition of microorganisms, is directly opposed to biotin in physiological action. The hypothesis that cells which require biotin as a growth factor are inhibited by avidin, is generally accepted. This growth inhibitor factor (avidin) is present in the white of eggs. Recent but inconclusive research indicates that avidin offers possibilities in dealing with carcinomatosis, both prophylactically and therapeutically. Cases of cancer in humans have been treated with large quantities of egg white with apparent benefit. However, so many cancer bubbles have been exploited and then exploded, that those engaged in cancer research have become ultraconservative and cautious about publicizing their work, because newspapers will grab and elaborate upon any straw that offers the slightest hope of controlling this dread disease.

The basis for the avidin treatment for carcinomatosis lies in the observation that several types of cancer contain abnormally large amounts of biotin and it is thought may require this vitamin for growth. Avidin by neutralizing the biotin might starve the cancer cells.

Army and civilian veterinarians who handle small animal cases have unexcelled opportunities to make contributions to this biotin versus avidin concept. For example, both in practice and in laboratory work, the writer has diagnosed cases of carcinomatosis of the uterus, vagina, anus, labia, mammary glands, and peritoneum, and also benign uterine fibromas, osteomas, conjunctival and buccal papillomas, myomas and chondromas. In reviewing clinical case records, it was definitely noted that dogs suffering from neoplasms usually have been well fed or overfed and have a history of having received heavy protein rations. The author recalls three cases of old female dogs that were given vitamin B complex regularly to stimulate appetite and digestion that later developed mammary neoplasms. Immediately, the question arises as to whether or not the vitamin therapy in these cases was merely a coincidence; prob-

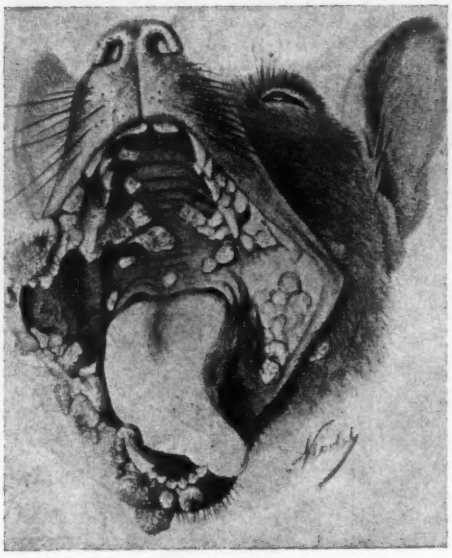
*Biotin is absent in all pure carbohydrate nutrients.

ably it was since both obesity and mammary tumors are common in such dogs.

Vitamin "K" Therapy

Case No. 1.—Recently, a police dog, 11 years of age, was brought to the clinic with a cauliflowerlike, hemorrhagic proliferation which was diagnosed as a labial cancer. Extirpation was advised and carried out with free excision of the surrounding tissues using "nupercaine" as the local anesthetic. Despite drastic surgery to get the carcinoma roots, the proliferative new growth recurred within a month. Again extirpation was resorted to with even more drastic surgical measures. When the animal was brought back a third time, the malignancy was more in evidence than ever with swelling of the adjacent, submaxillary lymph glands indicating metastasis. Five milligram doses of vitamin "K" (Lederle), twice daily on an empty stomach was then advised. This treatment was continued regularly for two months, and given once daily from then on. After one year of this treatment, the tumor had not recurred and there were no further signs of carcinomatosis. Was this purely a coincidence?

Case No. 2.—Collie dog, aged eight years, overweight, overfed and lazy, developed hemorrhagic stools and blood extravasations from the penis; despite treatment with hemostatics, the condition became chronic and the animal grew progressively anemic and emaciated. Microscopic examination revealed exfoliated epithelial casts and much cellular debris. The inguinal lymph glands became hyperplastic and the dog finally went off its appetite entirely. Cancer was suspected and confirmed by an exploratory laparotomy. The usual bloody, spongy mass of new growth was present around the mesentery and peritoneum, some ineffectual extirpation was attempted and the animal sutured up following ligation of several mesenteric vessels. Because the animal was suffering from internal hemorrhages, vitamin "K" (Abbott), was given to promote clotting. Five milligrams, three times a day was given until the hemorrhages ceased, then twice a day and later only once daily but always on an empty stomach to facilitate absorption. In addition, because the nutritional problem was so difficult due to emesis and bloody diarrhea, the dog was force-fed six egg whites a day. Under combined egg white and vitamin "K" therapy, the blood extravasations finally ceased and the dog showed slow but progressive improvement. On the understanding that a postmortem examination would be permitted, at the owners request the dog was destroyed after two months. Necropsy revealed extensive hyperplasia of the mesenteries and of part of the peritoneum. The tumor mass was no longer pulpy, bloody and proliferative but smooth, shrivelled up, almost hyaline and flat —quite definitely non-malignant in appearance. The lymph glands were no longer enlarged and the intestinal mucosa, while thickened, was not hemorrhagic. The spleen was still somewhat enlarged and the stomach showed some nodules in the pyloric zone. The evidence was that of arrested carcinomatosis. No conclusions were drawn but there could be no heresy in pondering the laws of chance.



There were dozens of papilloma diffused all over the roof of the mouth and on the buccal membranes

Case No. 3.—A cocker spaniel, five years of age, suffering with multiple buccal papilloma, was presented for treatment. The animal had half a dozen verruca with well defined necks and cauliflowerlike heads, which were easily extirpated under local anesthesia. One or two months later the cocker was brought back with literally dozens of papilloma diffused all over the roof of the mouth, sublingual and lateral buccal membranes of both cheeks.

The synthetic production of biotin, a recently discovered vitamin of the B group, was announced, May 14, 1943, by chemists in the research laboratories of Merck and Company. Biotin was at first known as vitamin H.

Again operative technic was resorted to and upwards of a hundred papillomatous growths were excised one by one. It was a tedious job that took more than an hour to accomplish. This dog was given 2½ milligram doses of vitamin "K" b.i.d on an empty stomach as postoperative treatment, and after six months there has been no recurrence. A few warts that could not be reached during the operation gradually shrivelled up and disappeared. Because papillomas do sometimes disappear, apparently without other than dietetic treatment, again no conclusions were drawn.

Case No. 4.—A Boston bitch, aged nine

years, was presented for treatment with multiple breast neoplasms. She was extremely fat, sluggish in temperament and had a positive history of gross overfeeding. This dog had been given vitamin capsules, a great deal of milk, meat, liver and candy. One mammary tumor, after rupture with weeping serohemorrhagic exudates, later became infected and emitted a foul odor. The owner refused operative interference, so the dog was given vitamin "K" (Lederle) 2½ milligrams t.i.d. She was fed mostly egg whites and vegetables and the tumefactions gradually subsided and the operation was temporarily averted. How the case finally terminated is not known.

Case No. 5.—An aged Scottie had an ugly carcinoma which was removed. She showed some temporary improvement under vitamin "K" therapy, with cessation of observable recurrent tumefaction, however, the dog was destroyed by the S.P.C.A. before further conclusions could be drawn.

Presumptive Conclusions

1. By decreasing the biotin containing food and increasing those containing avidin, neoplasms including cancer possibly may be arrested or even prevented. Further investigations are obviously indicated.

2. In their early stages canine neoplasms may possibly be cured by feeding large quantities of pure egg white (the whites of a dozen or more) twice a day. Avidin is the growth inhibitory factor present in egg albumen.

3. Vitamin "K" administered in doses of 2 to 5 milligrams, on an empty stomach, two or three times daily, possibly may exert some influence in checking growth and metastasis of malignant tumors.

4. Combined avidin and x-ray therapy with decreased vitamin B in the diet, as a possible means of cancer control in persons, may be worthy of some painstaking research and long-continued statistical observations. Veterinarians should share in the work on this problem, both through animal research and by clinical observation.

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In a very recent trial Rhodes and Abels (Memorial Hospital, New York) gave two cancer patients 16 to 40 times the avidin required to bind the biotin in their diets without influencing the new growths in either case. The doctors caution, however, that no conclusions can be drawn from this small number of cases.

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Practical Livestock and Poultry Nutrition

By L. D. FREDERICK* and R. E. GRAY*
Chicago, Illinois

How to Calculate Nutritive Ratios

ONLY the digestible portion of a feed contributes to the nourishment of an animal. In comparing the nutritive values of different feedstuffs, the total amount of *digestible* nutrients in each must be known if the comparison is to be at all accurate. Digestible nutrients are defined as the energy-producing substances, including carbohydrates, fats and proteins. In determining the total digestible nutrients of a feed an assay is first made to determine the total amount of carbohydrate, fat and protein contained in it. Then the same type of feedstuff is fed to livestock. An examination of the excreta shows how much of the total feed consumed was actually absorbed by the animal, and this figure represents the total digestible nutrients of the feedstuff.

Fat Is the Leading Energy-Producer.—Fat produces 2.25 times as much energy per pound as does either carbohydrate or protein. In calculating the total digestible nutrients its weight is multiplied by 2.25 before it is included. When this is done all three classes of energy-producing feed elements—fats, carbohydrates, and proteins—are expressed in equal terms of energy producing value. And their combined weights give the T.D.N. or total digestible nutrients.

Great Variation in Different Feedstuffs.—The percentage of T.D.N. in different feedstuffs varies greatly. For that reason, in the formulation of mixed feeds, it is important to have on hand figures indicating the relative energy producing value of all of the common feedstuffs. The university, government and industrial laboratories have, through research, established the digestibility of the various feedstuffs. These figures are available in the U. S. Department of Agriculture yearbook, in pamphlets prepared by schools of agriculture and in most books dealing with livestock nutrition. The nutritive ratio is a relative measure of the protein supplied by different feedstuffs.

Of the three basic feed elements, protein is the most expensive. To manufacture feeds which will supply all the essential proteins, at the lowest possible cost, it is necessary to know how much digestible protein is supplied by each of the common feedstuffs. The term "nutritive ratio" is used to express the ratio between the digestible protein and the remaining non-protein digestible nutrients. With the aid of a table showing digestible nutrients, and digestible protein, this ratio can be calculated as follows: The amount of non-protein digestible nutrients is found by subtracting the digestible protein from the total digestible nutrients. This figure is then divided by the amount of digestible protein, giving the ratio of non-protein substance to protein, which is expressed as unity. For example,

Digestible nutrients are energy-producing substances — carbohydrates, fats and proteins are examples. Fat leads as a digestive nutrient as it produces 2.25 times as much energy as either carbohydrate or protein.

the nutritive ratio of well dried dent corn having 83.7% T.D.N. and 7.4% digestible protein is computed as follows:

Total Digestible Nutrients	Digestible Protein	Non-Protein Foodstuff
83.7	7.4	76.3

The proportion of protein to non-protein nutrient is, therefore, 7.4 to 76.3 or, by dividing 76.3 by 7.4 or 1 to 10.3. This ratio expressed in tables as 1:10.3, means that for each pound of digestible protein in the corn, there are 10.3 pounds of other digestible non-nitrogenous nutrients (carbohydrates and fats).

The same ratio can be obtained by a slightly simpler method which, while giving identical values, does not show so clearly the relation of the terms involved. How-

*Research laboratories, Swift & Company, Chicago, Illinois.

ever, if many calculations are to be made, this simplified formula may be used as a short cut. In this method the percentage of total digestible nutrients is divided by the percentage of protein in the T.D.N. From this percentage, 1.0 is subtracted, giving the second term of the nutritive ratio. For corn the procedure would be as follows: 83.7 (T.D.N.) 7.4 (Dig. protein) = 11.3 (% of protein in T.D.N.). 11.3 — 1.0 = 10.3 (second term of the nutritive ratio). Since the first term is 1.0, the ratio becomes 1:10.3, the same as for the other method.

These ratios, once obtained, are valuable aids in comparing the richness of various feeds in protein, and are more reliable than comparisons based on percentage of crude protein. Like the values for total digestible nutrient and digestible proteins, nutritive ratios may also be obtained from tables included in feed handbooks.

Feeds rich in protein as compared to carbohydrates and fats are said to have a "narrow nutritive ratio," i.e., the second factor of the ratio is not much different from the first. Thus, 55% protein meat scraps, with a 1:0.5 ratio of digestible protein to fat and carbohydrates is said to have a narrow nutritive ratio, while rye hay has the wide nutritive ratio of 1:57.9. Corn, with a ratio of 1:10.3 has an intermediate value.

In selecting feeds to supplement the diet of livestock receiving a low protein diet, we must naturally turn to protein concentrates. The relative richness of these is shown by the nutritive ratios. Thus, it is possible to select the protein concentrate which, on a cost per pound of digestible protein, gives the most economical supplement. Likewise the formulation of a complete mixed feed is simplified and made more accurate when digestibility and relative richness in protein of the foodstuffs obtainable are taken into consideration.

The Feed Requirements of Poultry

The North Carolina Agricultural Extension Service in Extension Circular No. 245 (Oct. 1940) have summarized the requirements of the various type of poultry for the more important feed nutrients. The figures given in this bulletin are in general agreement with results obtained by similar workers all over the country. The following table shows these requirements in terms of the total ration, that is, an all-mash feed should have the composition shown. A mash designed to be fed with home-grown grains should be such that the mash together with the grain would have this composition.

NUTRITIVE REQUIREMENTS OF CHICKENS

	Protein %	Phosphorus %	Calcium %	Manganese P. P. M.	Vitamin A Intl. Units per lb.	Thiamin Micrograms per lb.	Vitamin D A.O.A.C. Units per lb.	Riboflavin Micrograms per lb.
Growing chicks	21	0.7	1.1	50	1,450	540	180	1,670
Laying stock	16	1.0	2.4	50	3,150	540	360	680
Breeding stock	16	1.0	2.4	50	4,720	540	540	1,250
NUTRITIVE REQUIREMENTS OF TURKEYS								
Growing poults	25	1.0	1.6	50	3,630	540	360	1,670
Breeding stock	16	1.0	2.4	50	4,720	540	540	1,250

Protein Requirements. — Research has definitely established that poultry need proteins of high biological value. Laboratory chick growth studies have shown that most animal proteins, such as meat scraps, when fed alone are superior to most vegetable proteins such as contained in cereal grains. Animal proteins supply a more complete mixture of the essential amino acids. However, this does not give a true picture of the relative merits of the two types of protein in a mixed feed. Certain vegetable proteins, such as those contained in soybean oil meal and peanut meal compare favorably with animal proteins in amino acid composition. However, soybean oil meal may only partially, not entirely, replace

Artifically dried, or dehydrated, alfalfa contains several times as much vitamin A as does sun-cured alfalfa. The destruction of vitamin A is fairly rapid during the first few months of storage of the grain or hay containing it.

meat scraps in a poultry ration. By properly blending a mixture of animal and vegetable proteins, a product may be obtained with a protein value equal to that of a product whose protein is derived almost entirely from animal origin. The cost of the ration is thus lessened.

In general, 25 to 50% of the total protein in a poultry ration should be of animal origin. For rapid growth, such as is required in raising broilers, it is best that feed contain the higher level of animal protein, i.e. 50%.

Rations consisting chiefly of vegetable protein produce eggs of low hatchability. One-half the total protein in a poultry breeder ration should be high quality animal protein.

Vitamin Requirements.—By proper choice of high-quality, vitamin-rich, natural feedstuffs, it should not be necessary to use vitamin concentrates. However, by wisely selecting the ingredients and concentrates, it may be possible to decrease, in some degree, the cost of a mixed feed.

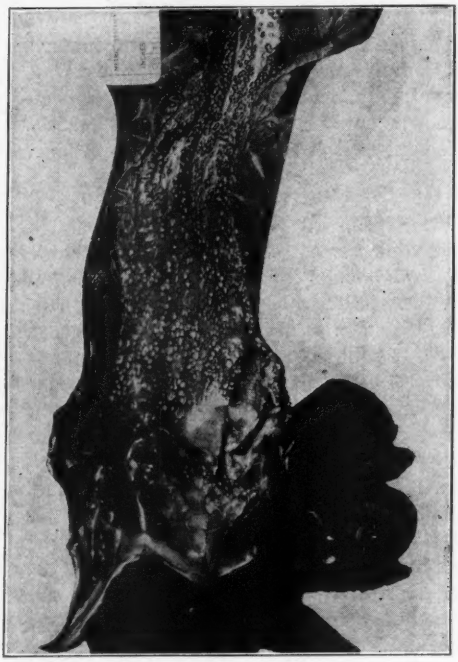
Sufficient amounts of vitamin A in the form of carotene may be obtained readily from the higher grades of alfalfa meal or alfalfa leaf meal. Artificially dried, or dehydrated, alfalfa contains several times as much vitamin A as sun-cured alfalfa. Yellow corn is also a significant source of this factor. It is usually advisable to formulate a ration containing somewhat more than the recommended amount of vitamin A because this vitamin is gradually destroyed or inactivated upon exposure to the air during storage.

Vitamin D may be supplied by fish oils or by the new D-activated animal sterols. Any vitamin D concentrate used in poultry feeds should have its vitamin potency expressed in A.O.A.C. chick units. There are certain forms of vitamin D which, while satisfactory for some animals, have no value for poultry feeding.

It is very important that sufficient riboflavin be included in poultry feeds. This factor not only affects growth but also egg production and hatchability. It may be supplied in significant amounts by meat scraps, dried milk by-products, alfalfa meal, alfalfa leaf meal, liver meal and certain dried fermentation residues.

In general, if vitamins A, D and riboflavin are present in adequate amounts in a poultry ration the other vitamins will also be available in the required amounts.

Mineral Requirements.—The recommended levels of calcium and phosphorus for a poultry ration are shown in the table. It may be advisable at times, however, to supply some other source of calcium—free choice. This is especially desirable for high-



Lesions caused by experimentally produced vitamin A deficiency in esophogus of a fowl

producing layers. Oyster shell grit or flour, or limestone grit are equally satisfactory.

Most feed mixers now add manganese and iodine to their poultry feeds. There are a number of convenient ways of doing this.

Common salt is an essential ingredient of all poultry rations. Without this substance chicks will fail to grow. From 0.5 to 1% is the correct amount to use.

Fat Requirements.—The ability of the chicken to digest fat is apparently very limited. About 5% in the ration is the best level. Normally the cereal grains and other ingredients will contribute this amount so that extra fat is unnecessary.

Carbohydrate or Energy Requirements.—The cereal grains are probably the cheapest source of carbohydrates for poultry. Many feed mixers formulate their feed so that the feeder may utilize his own home-grown grains as the chief source of this nutrient. The level to be used in the ration depends upon the purpose for which the ration is fed. A fattening ration, for example, should be relatively low in protein and relatively high in easily digestible carbohydrate.

For tables showing the protein, mineral, fat, and vitamin content of some of the more common feedstuffs, refer to the well-known, authoritative textbook, "Feeds & Feeding" by F. B. Morrison—XX edition.

Feed Requirements of Swine

The feeding, care and management of the breeding herd is of the utmost importance if economical swine production is to be had. Numerous items not discussed in this paper are equally as important as good feeding and rationing. However, without an adequate, well balanced diet for the various periods of growth and production, unsatisfactory and even disastrous results are common.

All authorities agree that it is advantageous to provide the breeding herd, particularly the brood sows, with good pasturage as much of the time as possible while they are carrying pigs. In addition to this, they should be fed a sufficiency of grains, supplemented with protein supplements and minerals in the proper amounts for satisfactory embryo development and the maintenance of a good thrifty, healthful, general physical condition of the sow in order that the litters be large, strong and thrifty and that there be an adequate milk supply for the pigs at the time of farrowing. However, sows should not be permitted to become overly fat. As most hogs are produced in the middle west, one method of being sure that the sows are well nourished is to feed the grain in controlled amounts twice a day and to supply the protein and mineral supplements free choice in separate compartments of suitable self-feeders. By so doing, the herdsman can judge the condition of the sows and increase or decrease the grain (it being the heat and energy producing part of the ration) at will. The sows seem to be able to judge just about how much protein and mineral supplement they require. The grain may be straight—one grain only—but carefully controlled studies indicate that better results are obtained when mixtures of grains are used. The only really satisfactory *single* protein supplement for swine is that of meat origin, it being either digester tankage or meat scraps. Numerous compounded or mixed protein concentrates are used quite satisfactorily in all hog feeding and raising operations. During recent years, since soybean oil meal has become a major item in the protein concentrate market, controlled feeding tests and production tests show that a concentrate made up of half digester tankage or meat scraps and half soybean oil meal have produced quite satisfactory results. On the average, smaller proportions of the animal origin protein have not been as satisfactory. For that group of swine raisers who desire to use a completely mixed ration for their brood sows particular attention must be given to the amount and quality of protein concentrate added to the mixture to insure protein adequacy. A good guide to use in the estimation of such a ration is suggested as

If the sow and pigs are being maintained in a restricted area and do not have access to green feed nor have direct exposure to the rays of the sun, then the ration should be supplemented with vitamin A and vitamin D feeding oil

follows. For the young gilts weighing between 200 and 300 pounds, a ration should have a nutritive ratio of between one part of protein to six parts of other digestible nutrients. A ratio up to 1:7 is desirable for the heavier, older gilts. The total digestible protein should run from 0.5 to .66 pounds and the total digestible nutrients from 3.5 to 5 pounds per head per day. For the older sows weighing from 400 to 500 pounds, the nutritive ratio should be an average of one part of protein to 6.5 to 7.5 parts of other digestible nutrients, and contain from .66 to .75 pounds of digestible protein and 4.5 to 6 pounds of total digestible nutrients per head per day. In the nursing period, the nutritive ratio should be narrowed somewhat; additional protein being supplied to where the ratio is not above 1:7 and from 1.25 to 1.5 pounds of total digestible protein with from 8 to 10 pounds of total digestible nutrients per head per day.

A high quality, complete mineral supplement should be supplied either free choice or mixed into some part of, or made an ingredient of, a completely mixed ration. In the latter case, to insure mineral adequacy, it should constitute 2 to 4% of the total feed consumed, depending on the normal mineral content of the feeds in the ration. If the sow and pigs are being maintained in a restricted area and do not receive direct exposure to the rays of the sun nor have access to green feed then the vitamin A and D of the ration should be supplemented with vitamin A and D feeding oil.

Weaned pigs, in their fast growing stage or from 30 to 125 pounds of weight, may be fed by any one of numerous methods but the feed requirements for rapid growth development and healthful vigor may be summarized for all practical purposes by the following rule. The ration should be graduated for the lower weight levels of the younger pigs from one part of protein to four parts of other digestible nutrients up to 1:6. The digestible protein should be graduated up from the lower weight limits from .25 pounds to .66 pounds for the larger feeder pigs. The total digestible nutrients should range from 1.25 pounds for the smaller pigs up to 4.25 pounds for the older heavier pigs, per head per day. Protein content of the ration at this rapid growing and developing stage as to quality and quantity is extremely important. Without an adequacy of high quality proteins in the ration, obtained by supplementing that of the normal ration by the use of meat proteins or mixtures of meat proteins and soybean oil meal, good results cannot be obtained.

It is usually considered that when pigs reach the stage of from 120 to 130 pounds they are then going over into the fattening and finishing period. The nutritive ratio is then widened. Not less protein but more of the fattening elements, derived from grains, are needed. The nutritive ratio at this stage of development should be approximately 1:6 for the lighter pigs, and up to possibly 1:7 for the fat hogs at the finishing for market period. The digestible protein range is from .66 to 1 pound and the total digestible nutrients from 4.25 pounds up to 7.75 pounds per head per day.

A high quality, complete mineral supplement should be either fed free choice, or it may be mixed into the ration in the amount of from 1 to 2% of the total feed being consumed by these older pigs and fattening hogs. The free choice method is usually recommended for adequacy and economy. If good yellow corn and an occasional feed of green alfalfa hay is fed to hogs in the dry lot and they are fattened during the time of the year when they are exposed to the direct rays of the sun, there is very little indication that vitamin supplements of the ration are necessary. However, in the winter or in areas having considerably cloudy weather and when white corn or small cereal grains are fed and no alfalfa is procurable, then vitamin A and D supplements are in order. Other essential vitamins are apparently supplied in adequate quantities in the average swine ration built around high quality, well matured grain mixtures, containing a major percentage of yellow corn and provided green hay or well cured alfalfa or lespedeza hay is furnished in moderate amounts and at least 50% of the protein in the ration is of animal origin.

(To be continued)

Autobiography of a Veterinary Practitioner

By E. T. BAKER, Moscow, Idaho

XVIII

Some Routine Cattle Practice

BLOAT used to be a "spring time emergency," in our locality, it now occurs almost every month. This may be due to the fact that many of our farmers raise sweet clover, and that there are cases of acute indigestion throughout the year on many farms.

As the average practitioner is not interested in a long-winded discussion on the cause, symptoms and general pathology, we will merely give our system of handling this serious ailment.

Bloat Medicines

We prepare two kinds of bloat medicine and, by doing a little missionary work at all times and while out on various calls, many of our clients purchase bottles of bloat medicine from us, which will not "taint" the milk. Mild bloat is a serious problem to the dairyman whose cows are always grain fed and so do not get the worst type of acute grass tympany. As a rule any medicine containing volatile oils, such as turpentine or the cresols, will give an objectionable odor to milk for nearly a week, and formalin seems to "knock" the victim's appetite, and often almost "dry up" a good milker. The remedy for these cases of mild bloat is made by mixing in a ten-quart granite bucket, two pounds each of sodium thiosulphate and sodium chloride; one level teaspoonful soluble saccharine; four ounces aromatic cascara; and one five-pound pail of Karo syrup; then filling the bucket with boiling water and stirring well. The dose is a pint as needed. Also, when we are called to see one of these delicate milkers, we give in addition 250cc calcium gluconate intramuscularly and, when there is a static condition of the rumen, a rumen stimulant and 2cc of lentin: In this way we can have the victim back to a full flow of milk within 48 to 72 hours. The client reciprocates by forcing a check on us before we can escape from the premises.

For cases of acute bloat when the victim is, as the client explains the situation, "blowed up tightern a drum," we always keep several dozen bottles on hand ready for immediate use. In a gallon bottle, pour eight ounces of aromatic spirits of ammonia; four ounces of any cresolis solution; sixteen ounces of oleum terebinthinae and four ounces of sulphuric ether. Shake well and fill the bottle with a good red mineral oil. The dose is one pint, mixed with one pint of the mild bloat remedy and given slowly as a drench. This can be repeated in a few minutes, if necessary, although we usually give a couple No. 7 Reeks' capsules, as a rule.

When we must use the trocar, we stand the victim with the head up hill, preferably against a fence. We can thus relieve

the gas with little struggling. After the rumen has become normal, pull out the canula and apply a little good antiseptic oil. Healing takes place in a few days. As we use a small teat knife to make the skin incision, it is very small.

USEFUL FOR BLOATS

This handy contrivance is made by running an electric wire through a piece of old hose. The wire is then fastened at the top. Being adjustable, it can be used on an animal of any size

Of course, other procedures such as the use of the stomach tube, can be followed, but our objection to this particular method is that if the cow inhales a few particles of liquid or food and coughs for several weeks, the owner will always claim "Doc done that when he poked that there tube down her gullet."

Complications

Years ago we used to think of bloat as merely a digestive ailment, but now we recognize many other complications. Eclampsia, grass tetany, milk fever, paralysis of the rumen and even on-coming mixed infection, such as hemorrhagic septicemia, may be involved.

Last year we were called to see a cow due to freshen. She staggered around until she could find a small creek to fall into, and the calf, about to be born, was drowned. Next, her entire uterus rolled out and she was bloated up until she could hardly breathe. We made a few appropriate remarks under our breath as we prepared to go to work. However, she was a sturdy "critter," and survived the treatment in great shape.

We impress upon our clients that bloat is merely a visible symptom of many other ailments; to take no chances but call us at once, if not sooner. We tell them if they give us a fair chance on their bloat cases, we will try to save their animals. We are now working on a bloat preventive powder to mix with salt.

Obstetrics

Obstetrics in large animals, such as the cow, is always a man-sized job, and it requires both mind and muscle to handle. Having delivered this sage observation, which every practitioner knows, let us give our method of handling these cases. Perhaps it will give some less experienced person a few helpful hints.

Equipment for Handling

We use a large zipper rubber suit; four-buckle high top rubber shoes; an old pair of trousers, an old sleeveless shirt, with the right sleeve of our union suit turned down over the shoulder. We are thus prepared for any emergency. We also carry a ten-quart aluminum pail; a gallon bottle of hot water; rubber gloves; antiseptics; etc.

In a small grip we carry a wire stretcher; four 30-inch obstetric chains; one 60-inch chain; four halter chains of varying lengths; four snaps; two chain handles and a couple embryotomy knives. We have found a fifteen cent pen knife with a curved blade, much like a pruning hook, valuable in many cases.

We also have a home-made set of obstetrical instruments which we carry along for the ride. A pair of good hands and arms do more for us than mechanical devices. We remember going out with an old time veterinarian on a call some thirty years' ago and, when he had unrolled all his instruments, it looked like the display at one of our state associations. He had everything, but about all they did was to impress the owner.

Position of Patient

As we have dressed at home, we are all ready for business when we arrive at the patient. First, we try to get her in a good place and apply our rope halter. We scout around for a place to attach our wire stretchers and hang our obstetrical chains in a bucket of warm antiseptic solution. All other equipment is ready at hand. As a routine, we administer 250 to 500cc calcium gluconate in the shoulder, intramuscularly.

We do this to prevent eversion, and it seems to keep down symptoms of milk fever. It also tends to promote normal expulsion of the afterbirth. If the calf is delivered alive, we do not attempt to remove the afterbirth.

Preliminary Examination

Having the patient in a good position and all our equipment ready, we make a preliminary examination. We are fairly sure to find one or more of the following complications:

a. Anterior presentation, with the head, one or both feet turned back, or twins, with both heads wedged against the pelvic outlet.

b. Posterior presentation, with one or both hind feet turned back, or twins.

c. A monstrosity, which is more commonly found in the beef breeds.

d. Too large a calf for the normal passage, such as may be found in a small heifer bred to a large bull. Some of the most difficult cases have been in this category. In many, presentation is absolutely normal, but the large head, shoulders or hips are just too big. To save a lot of hard work, when one recognizes a case like this, and it can be done, we perform embryotomy without delay. By removing the lungs and intestines and liver, often the fetus can be removed without too much trouble. The longer one waits to do this, the more grief he will encounter.

Actual Operation

After we make an examination, we rest a little while to think things over and devise a line of treatment. We may talk to the owner and tell him what we are up against

This cow was in a poor position for an attempt at delivery. However, the doctor persuaded her to get up and so was enabled to proceed

—the chances for a successful removal and so on. We never give any definite prognosis, nor do we even venture a guess on the likelihood of the calf living or not. We impress on the owner the situation is about as hard to figure out as women, baseball or politics. In other words, anything may happen. By doing this, we may save a lot of embarassment later on.

a—For an anterior presentation with the head or feet turned back, the first thing to do is to repel the fetus. We often use our home made repeller for this, allowing the owner or hired man the honor of doing most of the heavy work. As he pushes the calf back between strains, we make a noble effort to adjust the head or legs. If we can, we slip the 60-inch obstetric chain around the parts and, with the aid of our chain handle, have the owner do some fancy pulling as we raise the part up toward the

outlet. By keeping all hands busy, it impresses on them the gravity of the case and, in due time, the check for services rendered is more cheerfully paid. While the cow strains, take a short rest. After the head is brought to a normal position, bring the feet and legs to a similar position. This is often more difficult to do than to describe. However, with the aid of the chain, a foot may be pulled up by using the owner's muscle. After the calf is in a proper position and the chains are attached to both feet, start it out on its journey. Having everything ready, this can be accomplished in a short time for a delay may suffocate the fetus. Here is where fast work is necessary.

b—Posterior presentations are handled much the same way, as one can repel the hips and raise the legs and feet to a normal position.

c—For a monstrosity, no set rules can be followed, except to exercise ingenuity and handle the case as it is found. One of our last monstrosities was in a Shorthorn heifer. It had no front legs and its neck seemed to extend clear back to its navel. At first as we fished around for the front legs for quite a time we were puzzled. Finally, we put the chain on the head and pulled it out, but the abdomen and hips were too large, so we repelled it somewhat and performed an embryotomy with our fifteen-cent pen knife. After this was done, the fetus came out fairly easily. Had we not done this when we did, we might have been working on it yet.

d—Too large a fetus should be "righted" to normal position and then an embryotomy performed. By working fast, and not keeping the mother in agony too long and with the aid of some dextrose and sterile camphorated oil, most of these cases can be saved.

Since we have adopted this routine for our difficult calving cases, we hardly ever spend more than an hour or so on a case and save about 45 out of 50 cows. Our first consideration is to save the life of the mother; second, save the calf and third to not wear ourself out. Most of our dairymen call us early and we attribute much of our success to this factor. When a veterinarian is called to see a cow in the last stages of blood poisoning, with a fetus almost putrified, he is foolish to jump in and try to save the case and contract septicemia himself.

(To be continued)

Acute Tympanitis in Ruminants

Clinically, acute hoven is closely associated with normal fermentation and gas production in the forestomachs of ruminants. Moreover it is conditioned by both plant and animal factors. From investigations conducted on sheep with rumen fistulae and fed on different diets, it has been shown that lucerne stimulates fermentation and excessive gas production accompanied by a foaming up of the ingesta. Although extremely sudden in its onset, the process likewise subsides very rapidly, usually within 30 minutes. Fermentation of glucose, sucrose, and fructose by rumen ingesta *in vitro* results in a similar, fulminating type of gas production not seen with any of the other sugars tested, nor with starch, cellulose or protein. This characteristic fermentation is caused primarily by a species of false yeast cell present in large numbers, especially in the forestomachs of lucerne fed sheep. Through a process of fermentative assimilation, as already described for various other organisms, part of the sugar is synthesised into glycogen and stored as reserve carbohydrate by the yeast cells while the remainder is rapidly broken down to carbon dioxide, comprising the main gas evolved, and water. Copper sulphate in high dilution inhibits this process. Foam formation is aggravated by saponin present in lucerne. Due to the difficulties in regard to eructation, an excessive accumulation of intraruminal foam leads to overdistension of this organ, and subsequently to immobilization of the diaphragm. Respiratory distress accompanied by decreased return of venous blood from the abdominal region may result in sudden death.

The incidence of acute hoven may be limited by the feeding of a mixed diet in which green lucerne (alfalfa) is made to follow the other components, e.g., grass hay and concentrates.—J. I. Quin (1942) in *Jnl. So. Afric. V. M. A.* 13:3, p. 69.

Parasite in the Spermatic Sheath

Recently, when castrating an apparently normal yearling colt, I liberated a worm about 2½ inches long from the spermatic sheath. It was apparently wrapped around the spermatic cord. It seemed to be pointed at both ends and I think probably belonged to the strongyle family (likely a *Strongylus edentatus* which frequently wanders into the abdominal cavity). However, there was no opportunity to examine it more closely as it was lost sight of immediately on account of the struggles of the colt. From its location, I judged it had migrated down the cord from the abdominal cavity.

There was a complete absence of fluid in that side of the scrotum. I wonder, if this colt had not been castrated, if the presence of the parasite would have incapacitated him as a breeder or would the worm have eventually migrated back to the abdominal cavity.

Since this is the only case of the kind that I have met, in my 44 years' experience as a castrator, I believe that the condition is rare.

I would like to know if any other of the many reader of VETERINARY MEDICINE have ever run upon anything of the kind.

Winfield, W. Va. REMBRANDT MORGAN.

Recto-Vaginal Fistula with a Tear Through the Anal Sphincter

On March 3rd, a Holstein cow was presented with the following history. Two months previously the cow had had trouble calving and a recto-vaginal fistula resulted. This was complicated by a tear extending from the superior commissure of the vulva through the anal sphincter, creating a common opening. Apparently the fore feet of the calf had been pushed through into the rectum resulting in the recto-vaginal fistula. During expulsion of the fetus, the anal sphincter also was torn. The local veterinarian had advised the owner to bring the animal to the veterinary clinic of the Kansas State College.

A modified Forsell's operation was decided upon as offering the best prospect of conserving the breeding capacity of the animal. The animal was starved for three days by feeding only a small amount of hay and increasing the grain ration. On the third day, the rectum was emptied manually and the vagina and rectum were washed with warm soapy water and a mild antiseptic solution. Twelve cubic centimeters of a 1% solution of procaine hydrochloride was injected into the epidural space and the operation was performed in a standing position. To provide fresh surfaces for prompt healing, a transverse incision was made half way between the anus and vulva. This incision was continued a little beyond the anterior end of the fistula about one-half inch below the rectal wall. The tear in this wall was then closed with a Lembert type suture, using a dermoid suture. The edges of the wound were turned into the lumen of the rectum. The tear in the anal sphincter was then sutured in a like manner and divided at three points by inserting a sharp pointed narrow bladed knife subcutaneously and incising the muscle. This division of the sphincter muscle permits the feces to pass more easily, thus relieving some of the strain on the sutures.

The cow was sent home six days after the operation

Next, the vaginal wall was sutured in the same manner as the rectum (Lembert type suture) and the edges of the wound were turned into the lumen of the vagina. The tear from the upper commissure of the vulva to the anus was sutured last. After the operation, the grain ration was further increased while the hay was decreased. Six days after the operation the sutures were removed; the area sprayed with 1% aqueous pyoktanin solution and the cow sent home.

Since the fistula and tear were only six inches in length a modification of Forsell's operation was used, in that both the rectal and vaginal wounds were sutured perpendicular to the long axis of the animal and that the area between the rectum and vulva, which is usually left open for removal of the sutures, was completely closed.

WILLIAM DASELER

Oroville, Calif.

Salt Pork Poisoning in an Irish Setter

A three-year-old Irish setter was presented for treatment during the mid-morning on August 8, 1942, with the following history given by the owner, a restaurant keeper:

"With my dog I went to my restaurant as usual this morning at 6:15 a.m. About 15 minutes ago (10:15 a.m.) I left the restaurant to work my dog awhile. He followed me but just as I opened the car door and he started to jump in, he doubled up in a cramp and yelped with pain. I put him in the car and brought him here. I think he is constipated; a week ago I changed his diet to a commercial dry feed."

The dog walked with tucked-up abdomen and flanks and arched back. The entire abdominal region was extremely sensitive to touch, and he would yelp each time any part of this region was palpated. The mucous membranes were slightly congested; the temperature was 102.1°F., the respiration slightly increased as was the pulse (36 and 102 respectively). The eyes still looked bright and in terms of the owner—"He doesn't look so sick." Fluoroscopic examination revealed no foreign object.

The rectum contained hard, dry feces, but after a small amount of this material had been removed, mucus was found and a diarrhea seemed to be present. A tentative diagnosis of "poisoning" was made and the dog was hospitalized.

Two tablespoonfuls each of mineral oil and milk of bismuth were administered orally and the patient placed in quiet quarters for further observation. General depression set in during the next two hours and shortly after 1:00 p.m. a slight amount of vomitus was found. The bulk of this material was easily recognized as pork since very little, if any, gastric digestion had taken place. Immediately a mustard emetic was administered and soon chunk after chunk of what proved to be salt pork was vomited. When the vomitus appeared clear four tablespoonfuls of mineral oil were administered orally. Also, because of the dehydration now present, dextrose (65cc of a 5% solution) was injected intravenously and caffeine with sodium benzoate solution (1cc) was administered subcutaneously.

At 4:00 p.m. the oral mucosa was extremely red, there was a general paralysis, and the patient was markedly weakened. Dextrose, as given previously, was repeated. Convulsions set in at 4:25 p.m. and at 4:45 p.m. the patient died.

Autopsy revealed a severe gastroenteritis with the gastric mucosa greatly reddened.

Evidently the change in diet or some unknown element had resulted in an extreme hunger for meat or salt with the result that a large amount of salt pork was eaten.

KENNETH E. C. KIMBALL

Hillsboro, Kansas

Solanine Poisoning in Swine

An interesting case of poisoning in swine was observed last year. The hogs were a thrifty lot that had been fed a balanced ration consisting of corn, barley, tankage and minerals. They had had access to this ration since weaning. They were pastured on alfalfa that had made an excellent growth. Obnoxious weeds were quite plentiful in the fence rows and dry lots. These were mostly sunflowers, cockleburs, pigweeds, and buffalo burs.

Upon arrival at the farm, six of a herd of 36 shotes were in quite a serious condition; showing symptoms of weakness, accelerated pulse and respiration, mydriasis, restlessness, elevation of temperature and diarrhea. One pig was sacrificed for necropsy.

The post-mortem lesions were confined almost entirely to the digestive tract. The stomach was partially filled with green forage ingesta, some buffalo bur foliage was recognized in the contents. The walls of the stomach were reddened, with ulcerated

areas, 1 to 3cm in diameter, penetrating to the serosa. The mucous lining of the intestinal tract was likewise reddened and hemorrhagic. The intestine contained thin, greenish-colored feces.

As a test, the owner turned the hogs into a dry lot that was literally glittering with these yellow flowered plants. Many of the animals devoured the prickly weeds readily. The hogs were removed from this lot and all visibly sick animals were treated with 500cc of mineral oil *per os*. The owner was advised to remove all buffalo burs from the hog range. The results were quite gratifying, four of the sick treated succumbed, the remainder recovered and no further cases developed.

That the buffalo burr (*Solanum rostratum*) is a poisonous plant is not worthy of mention here, because it is a member of the nightshade family. Neither is the fact that swine eat these plants readily a new discovery; but ingestion of these plants to the point where toxicity and death occurred in the midst of a well-balanced supplementary ration and good alfalfa pasture is a rarity indeed.

WILLIAM J. SIMIC

Superior, Nebr.

Urinary Calculus in the Hog

January 1, 1943, a Poland China barrow weighing approximately 150 pounds, was examined. When approached, the hog got to its feet with apparent difficulty, walked several steps, and again lay down. A pronounced swelling posterior to the sheath, on the ventral part of the abdomen, was noted. Upon closer examination, the swelling would fluctuate and yield to pressure. An exploratory puncture with a one-eighth-inch trocar yielded considerable fluid of a decidedly urinous odor. The preputial hairs showed extensive collections of precipitated salts. Upon introducing a flexible probe into the urethra, an obstruction was encountered about two and one-half inches from the external orifice.

A diagnosis of rupture of the urethra with gravitation of urine into the subcutaneous tissue was made. As the animal was in no condition for marketing, the owner consented to an operation in an effort to save it. The patient was restrained in lateral recumbency and an area approximately six inches long and four inches wide, in the ischial region, was prepared aseptically for operation. Anesthesia of the part was obtained by injecting 10cc of a 1% solution of procaine hydrochloride into the skin and subcutaneous tissue.

Beginning about three inches below the anus, an incision was made downward, in the median line, for a distance of about 2½ inches. The subcutaneous and adipose tissues were separated for a depth of about three inches by using a sharp scalpel and blunt dissection. The penis was separated from the surrounding tissues for a distance of about three inches. A tight ligature was placed about the organ at the lower commissure and the structures severed distal to the ligature. The pelvic end of the penis was brought to the exterior so that about one inch of it protruded from the edges of the incision. A fixation suture was then placed at either side of the edges of the skin incision, at its upper part, to retain the penis in position. The ligature about the penis and urethra was removed. Several small calculi were discharged with the rush of urine that followed removal of the ligature. Two interrupted sutures were then placed through the ventral edges of the primary incision close to its lower part.

The patient was allowed to regain its feet. Expulsive efforts of the abdominal muscles brought about copious urination. The patient made an uneventful recovery.

The owner of the hog stated that he had suffered severe losses in his swine herd about a month previously due to an infectious enteritis. In an attempt to correct the situation, he had used considerable quantities of an alkaline mixture in the soaked feed. The high calcium content of the mixture may have been a predisposing factor in the formation of the urinary calculi in the hog examined.

LT. T. C. CAMPBELL, V.C.

Oklahoma City, Okla.

Abstracts

Sulphathiazole Topically in Infected Wounds

Fourteen grossly infected wounds, many of which had failed to respond to other treatments, including sulphonamides by mouth, were treated by the intensive local application of sulphathiazole.[33] The clinical infection subsided rapidly under treatment in every case, though usually the causative organism was not eliminated. Preliminary trials with the local application of warm saturated sulphathiazole solution, suggest that it may prove an efficient method of treating local sepsis. In routine clinical work at the present time, no other local antiseptic treatment of infected wounds should be attempted before the sulphonamides, preferably sulphathiazole, have been given an adequate trial.

Diagnosis of Leptospirosis

It is argued[31] that laboratory procedure must be adopted if accurate diagnosis of canine leptospirosis is to be made, and that examination of dark-field and of stained specimens, and guinea pig inoculation are unsatisfactory because of limited success in proportion to the time and effort expended. It is suggested that active infection may be diagnosed if typical symptoms of the disease are associated with agglutination at a titer of 1:1,000 or over, or if typical or atypical symptoms are associated with a rising agglutination titer of the serum, or if typical or atypical symptoms occur in conjunction with positive culture.

In infected dogs there is a primary septicemia stage with fever, together with gastroenteric symptoms, and weakness. The conjunctiva has a "muddy" appearance in all cases. This stage is followed by a toxic stage characterized by nephritic symptoms with uremia, or hepatic symptoms with cholemia, or a combination of the two. Severe dehydration with attendant emaciation will quickly occur in non-icteric dogs.

Of urban and suburban dogs under veterinary treatment for conditions other than leptospirosis, 19% gave positive agglutination reactions, but in hounds the percentage was only 2.04. 86% of the cases gave stronger reactions to *L. canicola*, and 14% to *L. icterohaemorrhagiae*.

Increasing Sheep Production Through the Control of Internal Parasites

Sheep losses caused by the nodular worm, the stomach worm and trichostrongyles are generally more serious in farm flocks than among range stock.[39] Death losses are of less significance than are the stunted size, the knotty intestines and the poor fleeces of lambs that survive infestations of parasites. It is estimated that nodular worms alone account for a yearly loss of about 100 million pounds of lamb as well as an estimated loss of six million dollars annually from parasitized intestines. Stomach worms also cause the loss of millions of dollars every year, mostly among lambs that acquire massive infestations so rapidly that death from anemia occurs before many symptoms are noticeable. Chronic stomach worm infestation, so common in yearlings and mature sheep, causes loss of weight and poor fleece. In a recent outbreak of trichostrongyles (black scours) in two mid-western states among about 16,000 lambs, the mortality was 9% and the surviving animals were left in poor condition.

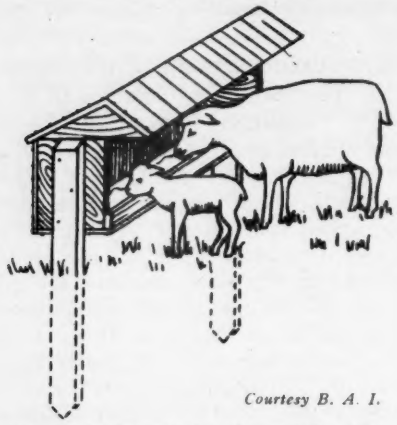
All three of these parasites of sheep can be controlled by medication with phenothiazine, good pasture hygiene and sanitation. There is not an abundance of this drug but efforts are being made to assure an ample supply for treatment as needed for the control of these parasites. The aim is to *prevent* morbidity and mortality. Curing animals from heavy parasitism is scarcely more than a procedure of last resort. The chief objective of anthelmintic medication is to remove the source of infection. Phenothiazine is the most potent drug for this purpose. Experience has shown that two treatments of the breeding flock, one just

[33] Green, H. N., and J. Parkin, 1942. Local treatment of infected wounds with sulfathiazole. *Lancet* (London), *243*, pp. 205-210. Abst. in *Vet. Bul. 13:5.*

[31] Coffin, D. L., and E. L. Stubbs, 1942. Observations on canine leptospirosis in the Philadelphia area. *Vet. Ext. Quar.* Univ. of Penn. *87*, pp. 3-14. Abst. in *Vet. Bul.* 13:5.

[39] Foster, A. O., R. T. Haberman and D. A. Shorb, 1943. Agricultural Research Administration, U. S. Department of Agriculture.

before lambing and the other just before grazing begins, are an effective means of control. For ewes in advanced pregnancy the first winter treatment may be given late in the fall or early in the winter, soon after the close of the grazing season. It is recommended that the drug be adminis-



Courtesy B. A. I.

A sheltered feed trough for phenothiazine and salt mixture

tered to them thoroughly mixed with moistened grain and that about one pound of this mixture containing about 25gm of phenothiazine, be fed to each animal.

In northern sheepraising areas, where pasture contamination is insignificant and infection is carried over in the breeding stock, medication must be given during the preceding winter to prevent or minimize contamination of spring pastures—this is particularly applicable to the control of the nodular worm. Sheep will voluntarily consume sufficient quantities of a suitable mixture of phenothiazine and salt to control reasonably effectively important gastrointestinal roundworms. The most satisfying mixture contains one part of the drug in 9 to 14 parts of loose salt. A good arrangement is to provide shelters where the mixture is protected from the weather and where sufficient quantity of the mixture may be placed in a container to supply 30 to 35 mature sheep for a period of two to four weeks. To encourage consumption it may be necessary to add, occasionally, a few handfuls of grain. This salt mixture should not contain more than 10% of phenothiazine. Because the voluntary salt consumption of sheep is greater during the warm months there is an increased intake of the drug during those periods when the risks from parasitism are greatest.

There are no injurious effects upon the sheep—fertility and reproductivity are unimpaired, the meat unaffected and the fleeces undamaged although they are slightly tinged.

To minimize pasture contamination in the spring, all sheep (except lambs) in the northern sheep-raising areas should be given 25gm of phenothiazine before they are put on pasture. Later the entire flock should receive the salt mixture. Good results are obtained by dosing at intervals of three to four weeks with the standard copper sulfate drench. As a safeguard against black scours each animal should be treated again in the fall or early winter with 25gm of phenothiazine, repeated in late winter or early spring before the breeder stock and lambs are put on pasture.

In the southern sheep-raising areas, it is advisable to administer the phenothiazine to all animals of the breeding flock (giving one-half of the regular dose to lambs) before the salt medication is initiated.

Vaccination Against Strangles

Attempts to produce a satisfactory vaccine for use in the prevention of strangles by treating strangles streptococci in various ways have in the past met with disappointing results.[28] A preliminary trial of various vaccines in army camps suggested to the author that young culture organisms, cautiously killed by a short exposure to a moderate heat, might provide a satisfactory immunizing agent. Accordingly, an extensive second field trial was carried out, involving the vaccination of over half of upwards of 4,000 horses. Strangles, as evidenced by the development of definite abscesses in the submaxillary region or elsewhere, which when opened gave typical strangles pus, was four times as frequent in the non-vaccinated as in the vaccinated group; analysis of the results obtained showed that the degree of protection conferred was statistically significant.

[28] Bazeley, P. L., 1942. Studies with equine strangles. *Aust. Vet. Jnl.*, 18, pp. 141-155. Abst. from *Vet. Rec.*, 55:2, p. 19.

One interesting feature was, that the strain of *Str. equi* used was almost certainly free from any possible strangles virus. The results obtained are cautiously estimated,

but the author feels that a definite advance has been made in tackling the immunological problem of strangles.

Facts and Fancies Concerning Brucellosis Control

Figures from 441 herds show[35] the progressive increase in the incidence of *Brucella abortus* infection in female cattle with increasing age. Whether abortion follows infection may depend on whether or not the animal is pregnant at the time when infection is acquired. Data regarding the influence of the size of the infecting dose on the outcome of infection in pregnant heifers show that a dose of more than $1{,}460 \times 10^4$ organisms is required to produce 100% infection in all the animals of a batch. When the infective dose is small, agglutinins may take several months to develop. The apparent resistance of calves more than eight months old may often be due to the time which must elapse between exposure to infection and pregnancy. There is no reason to believe that the calf develops a better immunity than the older animal.

In assessing results of vaccination experiments, it must be borne in mind that natural exposure to subinfective doses of the organism may produce natural immunity in a certain proportion of animals.

A satisfactory live vaccine should possess the following properties: (1) it should confer a satisfactory immunity, (2) the characteristics of the bacilli should remain constant, (3) its virulence should be such that it does not infect the type of animal for which it is intended, and (4) it should not cause non-infected, non-reacting animals to react positively to the serum agglutination test. It is concluded that the Ministry's old vaccine is unsatisfactory on account of the presence in it of fully virulent strains. Strain 19 vaccine used on calves appears to confer appreciable immunity at first calving, but it is doubtful whether the immunity persists. The strain also stimulates the production of agglutinins. Incomplete results of field tests on 88 herds vaccinated with 45 (20) are given which the author claims to be "not discouraging." In his opinion R strains of *Br. abortus* stimulate protective immunity as satisfactorily as S strains.

The author considered that, as long as inoculation is confined to non-pregnant cattle, the chances are slight that strain 45 (20) will become virulent. Two speakers stated that they had obtained good results with the Ministry's old vaccine.

Crystal-Violet Vaccine for the Prevention of Hog-Cholera

Believing that crystal-violet vaccine would be particularly useful in England if the claims made for it could be substantiated, Doyle[37] made a thorough investigation of the product. His report, because of the comprehensive plan of the work and the clear-cut results obtained, merits the consideration of everyone interested in the control of hog-cholera.

The vaccines studied were made by Doyle by treating hog-cholera virus with crystal-violet and a preservative, and incubating the mixtures for 14 days.

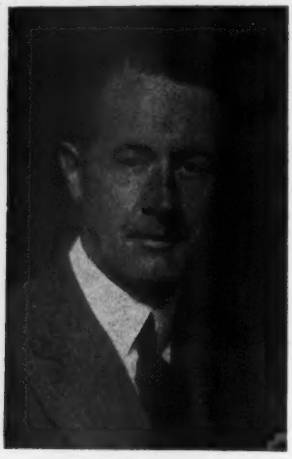
Four crystal-violet-phenol vaccines were first prepared by the method originally described by Dorset. When tested, these were not uniformly potent. Sixteen crystal-violet-disodium-phosphate vaccines were then prepared by the method later described by McBryde and Cole.

Two viruses of American origin were used to prepare all except one of the vaccines. The American viruses were particularly virulent—no pig exposed to them by injec-

[35] McEwen, A. D., 1942. Facts and suppositions relating to vaccination against contagious abortion. *Vet. Rec.*, 54, pp. 287-292. Abst. by De Ropp in *Vet. Bul.*

[37] Doyle, T. M., 1942. Crystal-violet vaccine for the prevention of swine fever. *Vet. Jnl.* (London), 98:3 and 4, pp. 51-66.

tion or contact survived. All vaccines were safe—vaccinated pigs did not develop a temperature or other visible reaction, nor did they transmit infection to unprotected pigs by contact. Three days of incubation sufficed to inactivate the virus contained in



T. M. DOYLE

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crystal-violet vaccine, but a 14-day period of incubation was used.

Crystal-violet-phosphate vaccines produced from the American strains of viruses were uniformly potent. Thus, in one series 12 such vaccines were used in doses of 2cc, 5cc, or 10cc on 206 pigs; all were later exposed to cholera along with 80 unvaccinated controls. Of the 206 vaccinated pigs five died, three reacted, and 198 remained well. Of the 80 controls, all died.

In tests of the duration of immunity, 17 pigs were treated with doses of vaccine ranging from 1cc to 10cc. One or more of the vaccinated pigs, together with an unvaccinated control, were exposed at monthly intervals up to nine months by virus injection or contact. All vaccinated pigs remained well; all controls died.

In tests against contact infection, 12 pigs were vaccinated with varying doses of four different vaccines and, after 96 days, held together with unvaccinated controls in contact with virus-injected pigs. Eleven of the vaccinated pigs remained well, one died; all unvaccinated controls and virus-injected pigs died. In a second experiment, separate groups, each consisting of three vaccinated pigs and one control, were held in contact with virus-injected pigs at 3, 6, and 10 months respectively, following vaccination. All vaccinated pigs remained well; all controls and virus-injected pigs died.

A phosphate vaccine prepared from an English field strain of virus lacked potency when tested against either the homologous strain or against virus of American origin. Vaccines prepared from American strains of virus protected against viruses of either American or English strains. Although the English strains were less virulent than the American, no evidence of a plurality of viruses was found.

Citrated plasma virus was found to afford a greater yield of vaccine than that obtained from defibrinated blood virus. A vaccine prepared from citrated blood was potent when tested 408 days after preparation.

In tests of the time required for vaccinated pigs to develop immunity, it was found that most of the vaccinated pigs given virus within 10 days of vaccination died. Pigs inoculated from the 12th to the 21st day remained normal. There was an abnormally short interval between inoculation and death in pigs tested 3, 4, 6, and 9 days after vaccination. The considerable interval between vaccination and complete development of immunity is considered to be the most serious limitation of the method.

In conclusion, Doyle states that the vaccine did not transmit infection, that it protected pigs against artificial and contact infection with hog-cholera, that potent lots could be produced with reasonable regularity, and that immunity lasted under the conditions of the test for a least 10 months.

Doyle's report receives favorable comment in an editorial in the same issue of *The Veterinary Journal*. The concluding statement of the editorial is:

"There is no doubt that in this new vaccine we have a product which, when used under field conditions still to be investigated, will be found of high efficiency in the control of swine fever in this country."

★ ★ ★ BUY WAR SAVINGS STAMPS AND BONDS

Book Reviews

Dictionary of Bio-Chemistry and Related Subjects, by *William Marias Malisoff,* Professor of Bio-Chemistry at the Polytechnic Institute of Brooklyn, and 46 collaborators. 579 pages. The Philosophical Library, New York. 1943. Price $7.50.

There have been no previous dictionaries of this kind. Many definitions are found too brief to be of much value while some are longer than warranted. Since this is a pioneering effort changes will doubtless be found desirable in future editions.

However, the work will prove useful to readers of the literature of biochemistry and allied sciences.

* * * *

Behind the Sulfa Drugs, a short history of chemotherapy, by *Iago Galdston,* M.D. Preface by *Perrin H. Long,* Associate Professor of Medicine, Johns Hopkins University. 174 pages. D. Appleton-Century Company, New York. Price $2.00.

But eight years have elapsed since the effects of the sulfa drugs (sulfonamides) upon streptococcal infections in mice were first described by Gerhard Domagk. This report was quickly followed, in many parts of the country, by experimental and clinical research upon the use of sulfanilamide and its derivatives. At the present time, however, physicians, and the laity as well, probably know more about its use, mode of action, etc., than about any other drug or group of drugs.

Since, during the past six years, sulfa drugs have been found to be almost a specific for many infectious diseases heretofore held to be incurable or practically so, these drugs are now almost universally considered as a modern miracle in medicine—a fortuitous circumstance in which the drug sort of evolved of itself.

Little is known, or even guessed, of the experimental work carried on by innumerable research scientists, year after year, which finally culminated in the production of these drugs.

This intensely interesting, little known, extensive background of this group of drugs is well told in "Behind the Sulfa Drugs." Included in this is a description of the development and the ever increasing achievements of chemotherapy.

Victories of Medicine, Scientific Accomplishments of the Medical Department of the United States Army by *Edgar Erskine Hume,* Colonel, Medical Corps, Army of the United States. 250 pages, many historical illustrations. J. B. Lippincott Company, Philadelphia, 1943. Price $3.00.

This is an interesting work, essentially a military medical history. The author seems to claim for the Medical Corps of the Army, credit for just about all the progress of medicine. Thus it was an army doctor who first recognized the importance of the polution of drinking water, who first practiced sanitary garbage disposal, who founded meteorology in this country, who founded bacteriology in this country and wrote the first text book on the subject, who introduced vaccination against smallpox, who founded anthropolgy in the United States, who first issued flood warnings, who kept the first weather statistics, who discovered that Puerto Rican anemia is hookworm disease, who first used ipecac for amebic dysentery, who first discovered the cause of dengue fever, who wrote the first text book on surgery, who founded neuropsychiatry in this country, who introduced photomicrography and who discovered the role of the mosquito in transmission of yellow fever.

The Medical Department of the Army, according to the unabashed colonel, was among the first to oppose the use of alcohol, was the first to employ annual physical examinations, the first to institute periodic eye examinations, the first to systematically combat venereal diseases, the first in America to keep vital statistics, the first to study ventilation, the first to employ typhoid vaccination on a large scale, also first in immunization against tetanus, typhus fever, cholera and yellow fever, the first to study the human foot, beri beri and gastric digestion. These are but examples of army medicine's contributions to medical progress. Many others are cited.

The Army Medical Library is "America's greatest gift to medicine" and is the largest collection of medical literature in all history. Its index catalogue is the greatest scientific bibliography of all time. Two chiefs of the Army Medical service founded the oldest medical college in the United States and a third chief became the first

professor of surgery in this country. The Medical Department of the Army established the first school of tropical medicine, the first army service school, the first army service publication, the first army reserve, and published the first official history of World War I.

The objective of the Medical Department of the army is to conserve the strength of the army. In this, one judges by inference the author finds the Medical Corps received little help from the other corps of the department. Thus it required 200 pages of his book to recount the notable achievements of the Medical Corps and medical officers, but to perform the same service for the Dental Corps took but four pages, for the Veterinary Corps two pages, and for the Nurse Corps 1½ pages. He was able to find no achievements of the Sanitary Corps or of the Medical Administrative Corps that are worthy of recording.

It is stated that the Army Veterinary School was established at Washington in 1920. It was established at Chicago in June, 1917. It is stated the number of veterinary officers on Armistice Day of World War I was 2002. The correct number is 2184. The author speaks glowingly of the control of infection in wounds by the use of sulfa drugs, following the catastrophe at Pearl Harbor, but does not mention that the army veterinary service had attained the equivalent results with sulfa drugs three months earlier.

In the reviewer's opinion, a number of achievements of the Veterinary Corps easily rank with various accomplishments of the Medical Corps which the author deemed worthy of mention. Food inspection in World War I may be cited as an example. The veterinary service inspected 1,779,848,621 pounds of food of animal origin at purchase. By October, 1918, purchases were at the rate of fifty million dollars worth per month! At that time the army's daily allowance for meat required more than 10,000 cattle and more than 22,000 swine. In the official report of the Quatermaster, it states "The work performed by this force (meat inspection) was of the highest order. . . . Hundreds of millions of pounds of meat were passed by them as complying with army specifications and there was no complaint as to quality or condition." After purchase, the same service followed the meat, meat products and dairy products through cold storage plants, ports of embarkation, shipment overseas, warehouses and rail heads until it was issued to the troops and "From no source was any criticism of food inspection heard." The loss from all causes was held down to less than 0.5%.

You may obtain any book reviewed in this department by remitting the published price to the Book Department of VETERINARY MEDICINE, 7632 S. Crandon Ave., Chicago, Ill.

Virus Diseases, by members of the Rockefeller Institute for Medical Research, *Thomas M. Rivers,* M.D.; *Wendell M. Stanley,* Ph.D.; *Louis O. Kunkel,* Ph.D.; *Richard E. Shope,* M.D.; *Frank L. Horsfall, Jr.,* M.D.; and *Peyton Rous,* M.D., Sc.D. 170 pages, 11 illustrations. Cornell University Press, Ithaca, N. Y. 1943. Price $2.50.

This volume comprises six lectures, one by each author. The subjects are: (1) virus diseases with particular reference to vaccinia; (2) chemical structure and mutation of viruses; (3) new hosts as a key to progress in plant virus disease research; (4) Swine influenza; (5) human influenza and (6) viruses and tumors.

Fifty years includes the whole span of our knowledge of filterable viruses and most of the available information on this branch of microbiology has been developed within one-fourth of that period. Some difference of opinion exists among those engaged in virus research and many questions are as yet unanswered. Nevertheless, many facts about these peculiar agents have been established and are sufficiently interesting and important to warrant being brought together under one cover. In this volume six virus workers have attempted to do this —each for the field with which he has dealt and for which he is particularly fitted. Although only two of the lectures, "swine influenza" and "viruses and tumors," deal directly with diseases of animals, the other lectures contain basic information and the work is indispensable to the veterinarian who would be informed and up-to-date on virus diseases.